US006575775B2

(12) **United States Patent**
Hasegawa et al.

(10) **Patent No.: US 6,575,775 B2**
(45) **Date of Patent: Jun. 10, 2003**

(54) CONNECTOR WITH SHORTING TERMINAL

(75) Inventors: **Teruaki Hasegawa**, Yokkaichi (JP); **Naova Kurimoto**, Yokkaichi (JP)

(73) Assignee: **Sumitomo Wiring Systems, Ltd.**, Yokkaichi (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/833,072**

(22) Filed: **Apr. 12, 2001**

(65) **Prior Publication Data**

US 2001/0036768 A1 Nov. 1, 2001

(30) **Foreign Application Priority Data**

Apr. 12, 2000 (JP) 2000-110650

(51) **Int. Cl.**[7] **H01R 29/00**; H01R 3/00
(52) **U.S. Cl.** **439/188**; 439/488
(58) **Field of Search** 439/188, 488, 439/489, 595

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,466,168	A	11/1995	Liebich et al.	
6,171,124	B1 *	1/2001	Kojima	439/188
6,247,957	B1 *	6/2001	Hasegawa	439/352

FOREIGN PATENT DOCUMENTS

EP	0852 413 A1	7/1998	
EP	0905 823 A1	3/1999	
JP	11-150566	* 5/1999	..... H01R/13/627
JP	11-329604	11/1999	

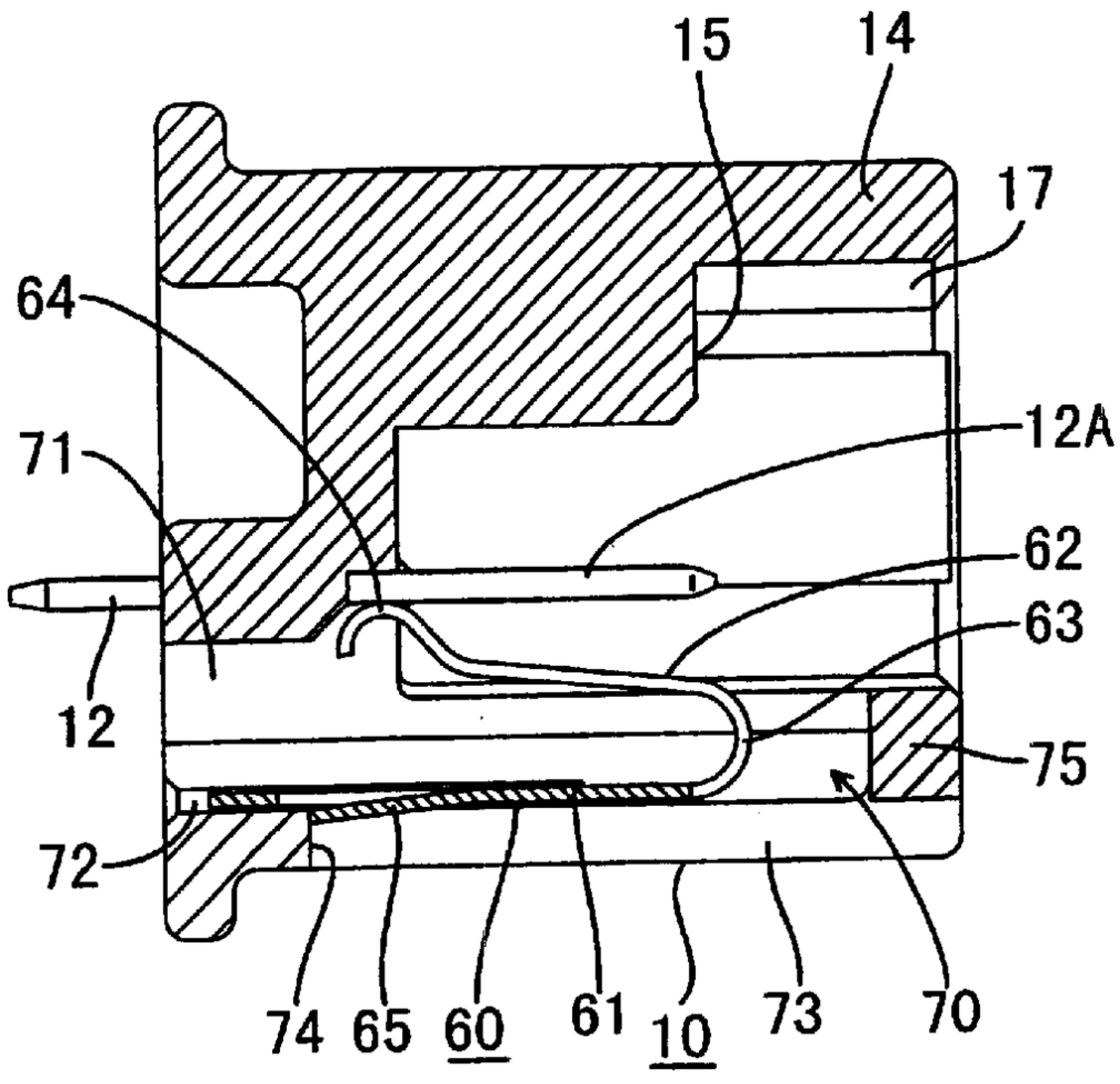
* cited by examiner

Primary Examiner—Tulsidas Patel
Assistant Examiner—Chandrika Prasad
(74) *Attorney, Agent, or Firm*—Banner & Witcoff, Ltd.

(57) **ABSTRACT**

A connector is provided with a shorting terminal. Male terminal fittings **12** protrude into a hood **11** of a male housing **10**, a female housing **20** fitting into this hood **11**. A left half of a lower portion of the hood **11** protrudes downwards, a shorting terminal housing recess **70** being provided at this location, this recess **70** housing a shorting terminal **60**. The shorting terminal **60** has four resilient contacts **62** which make contact with the male terminal fittings **12** and short-circuit them. The shorting terminal **60** can be inserted, from the posterior of the male housing **10**, into the recess **70**. A misalignment preventing wall **75** protrudes at an anterior end of the recess **70**. A protruding anterior end face of the misalignment preventing wall **75** forms a unified face with a right half of the lower portion of the hood **11**. As a result, an opening area of the hood **11** of the male housing **10** is approximately the same shape as a fitting area R of the female housing **20**, thereby preventing misalignment when fitting is carried out. The misalignment preventing wall **75** ensures that only a small part of the shorting terminal **60** is exposed to the exterior.

7 Claims, 12 Drawing Sheets



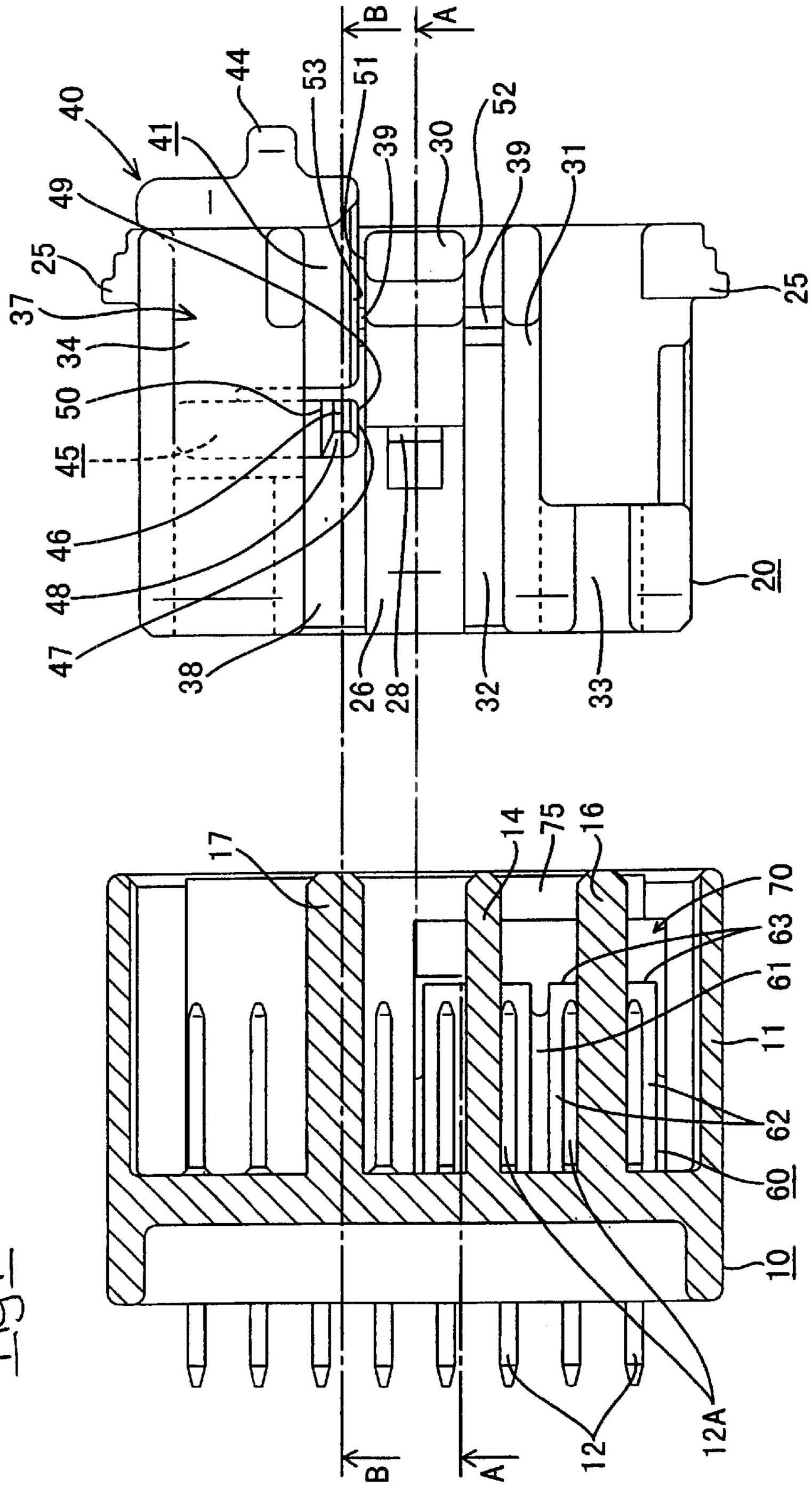
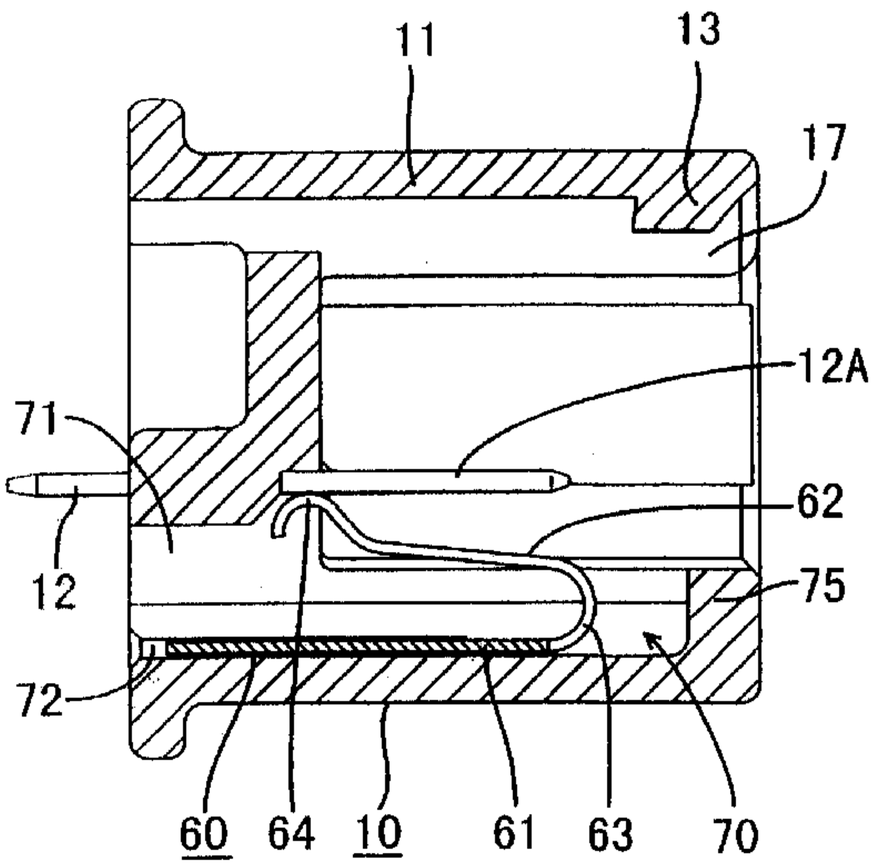

B
A
44
53
51
40
41
39
30
52
39
31
49
25
37
34
50
45
46
48
47
38
26
28
32
33
25
20
17
14
75
16
70
63
61
11
62
60
12
12A
10
B
A

Fig 1


11
13
17
12A
71
62
12
75
72
60
64
10
61
63
70

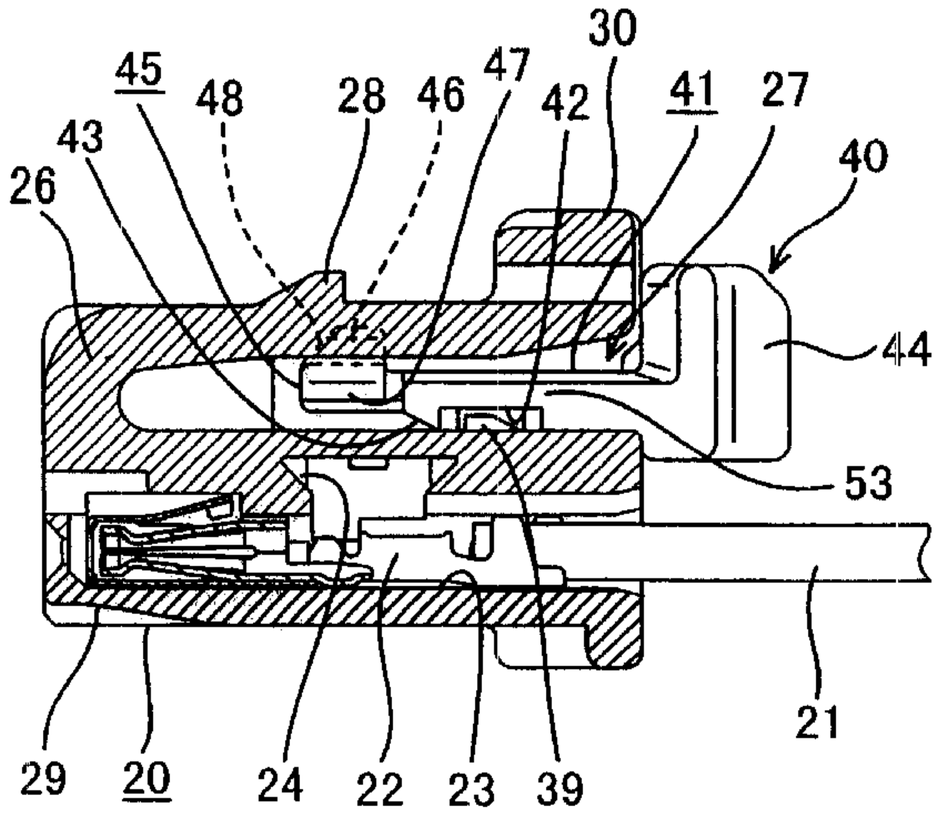
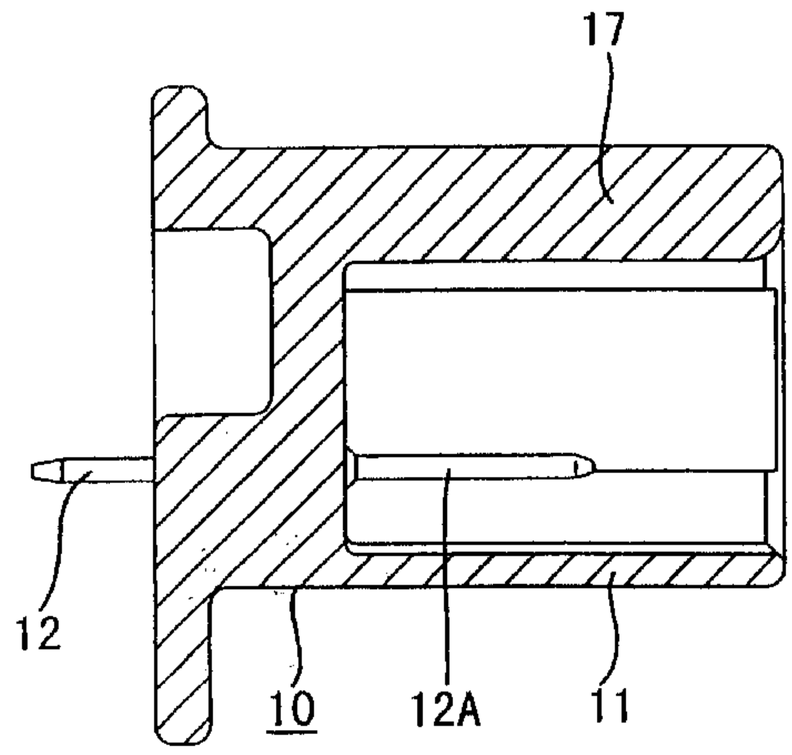

45
48
28
46
47
42
30
41
27
43
26
40
44
53
21
29
20
24
22
23
39

Fig2


17
12
10
12A
11

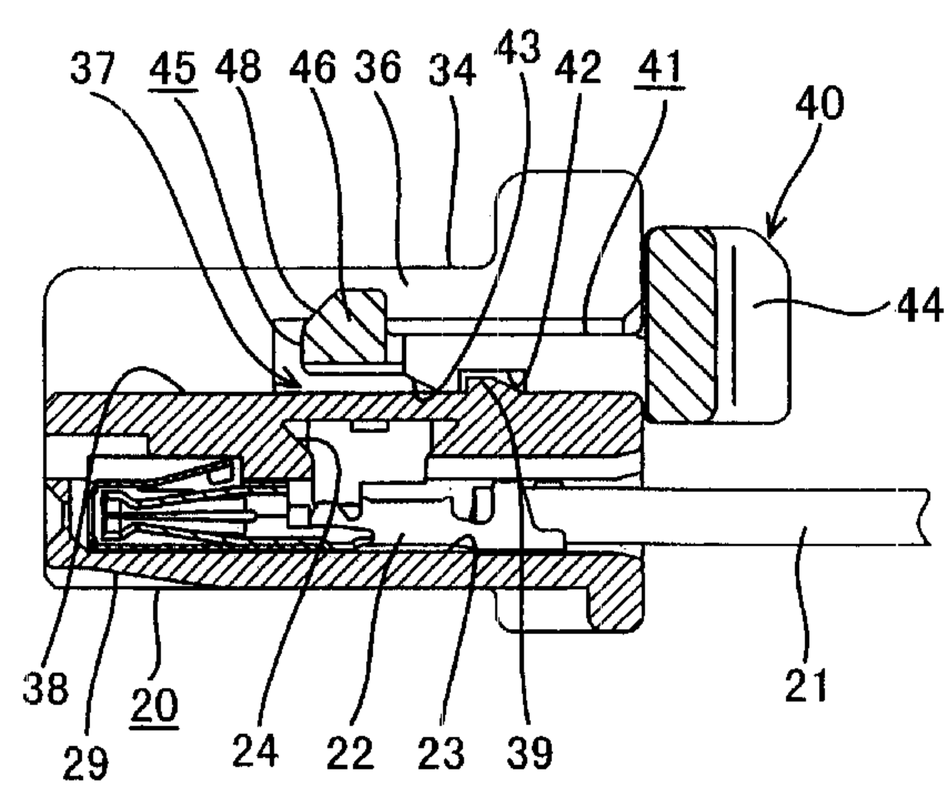

37
45
48
46
36
34
43
42
41
40
44
38
29
20
24
22
23
39
21

Fig3

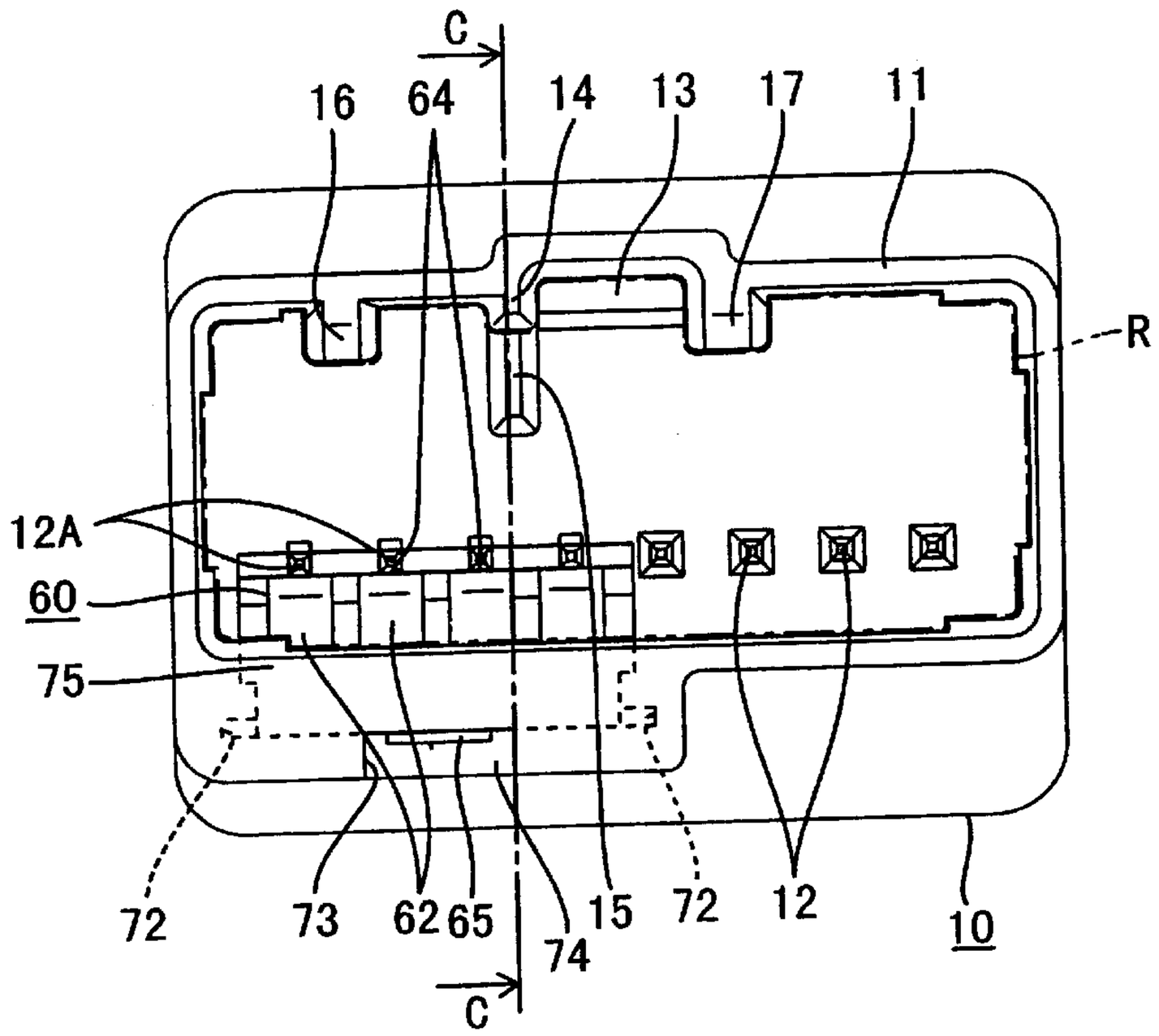

C
16
64
14
13
17
11
R
12A
60
75
72
73
62
65
74
15
72
12
10
C

Fig 4

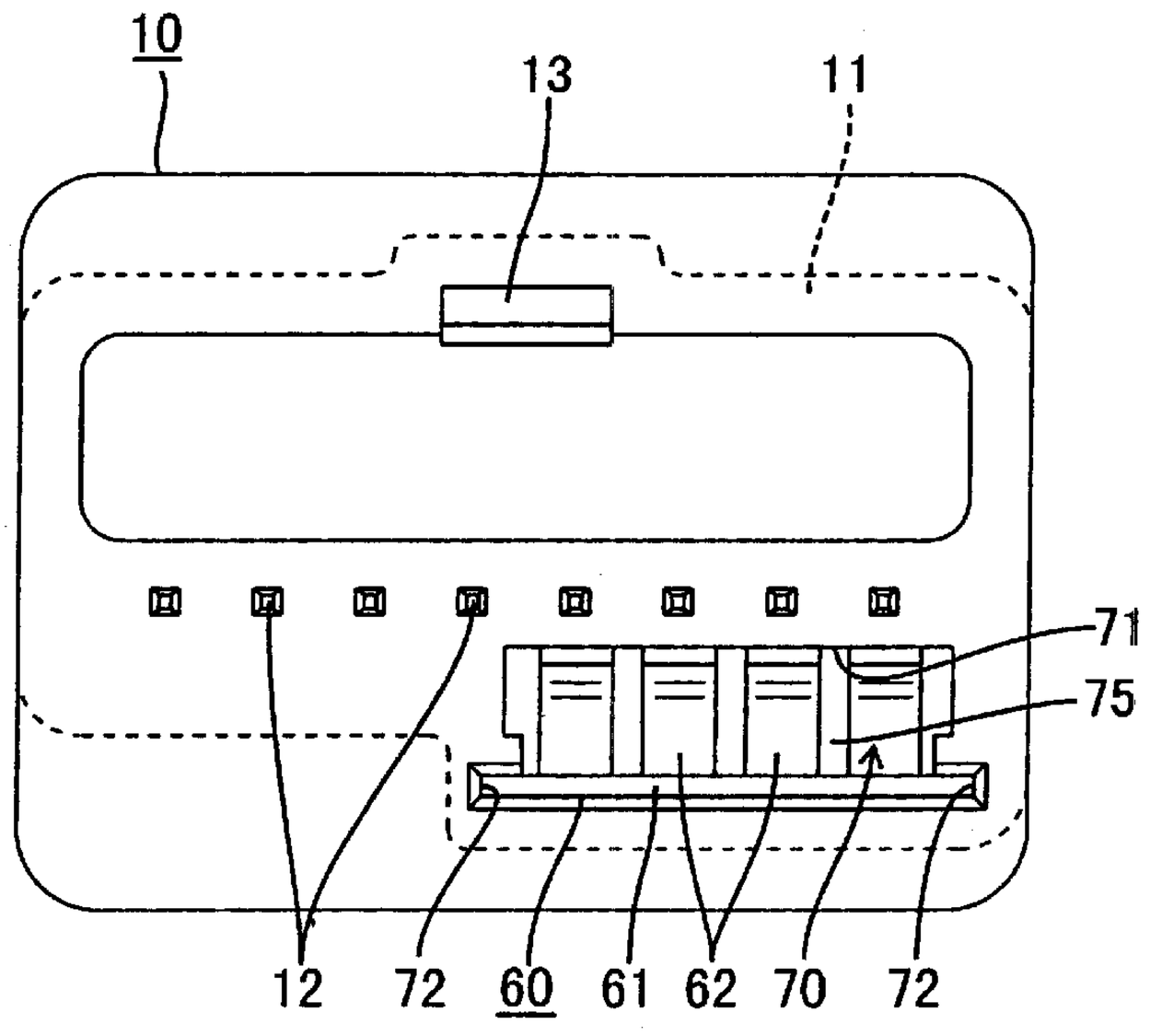

10
13
11
71
75
12
72
60
61
62
70
72

Fig 5

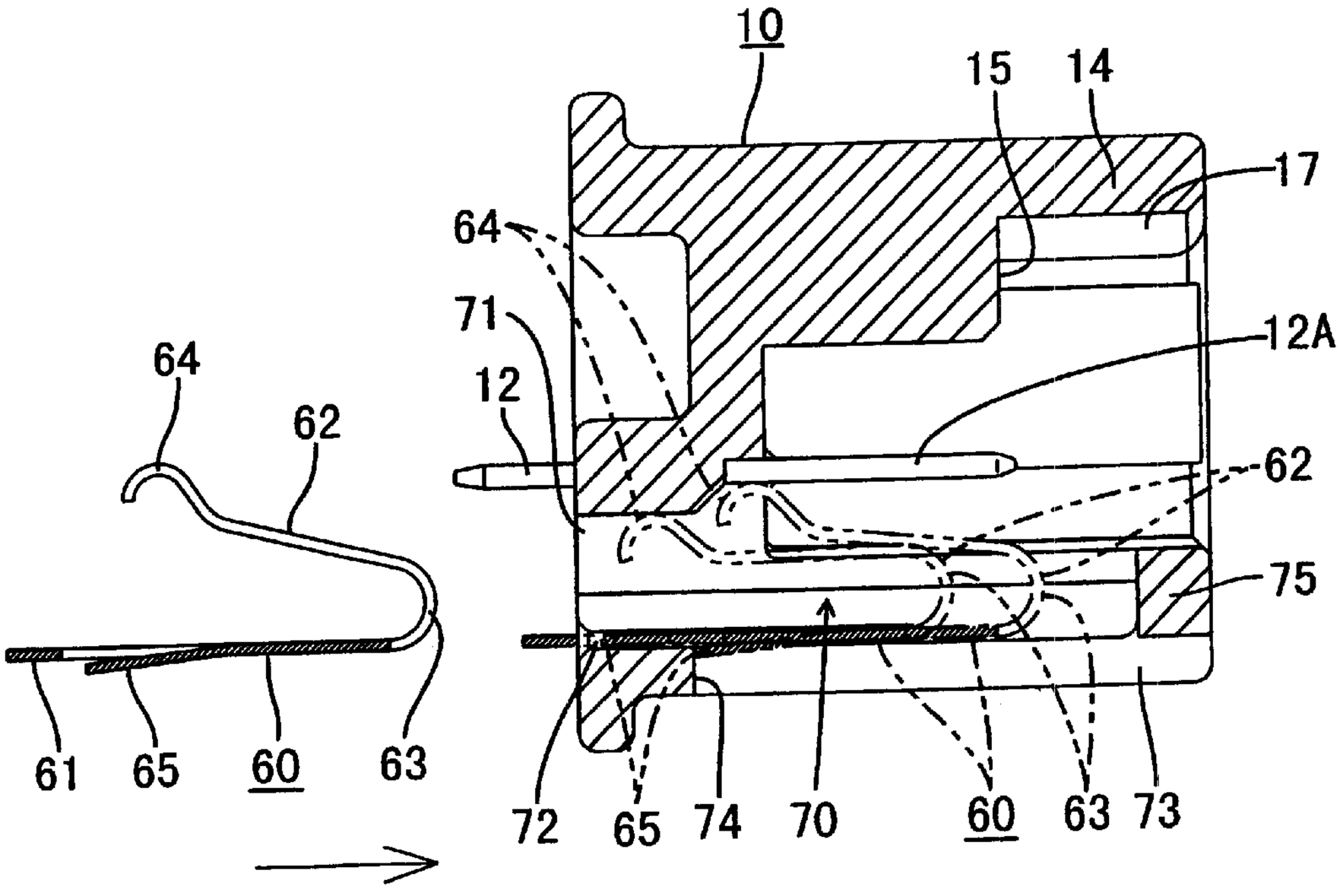

10
15
14
17
64
71
12
62
12A
62
75
61
65
60
63
72
65
74
70
60
63
73

Fig6

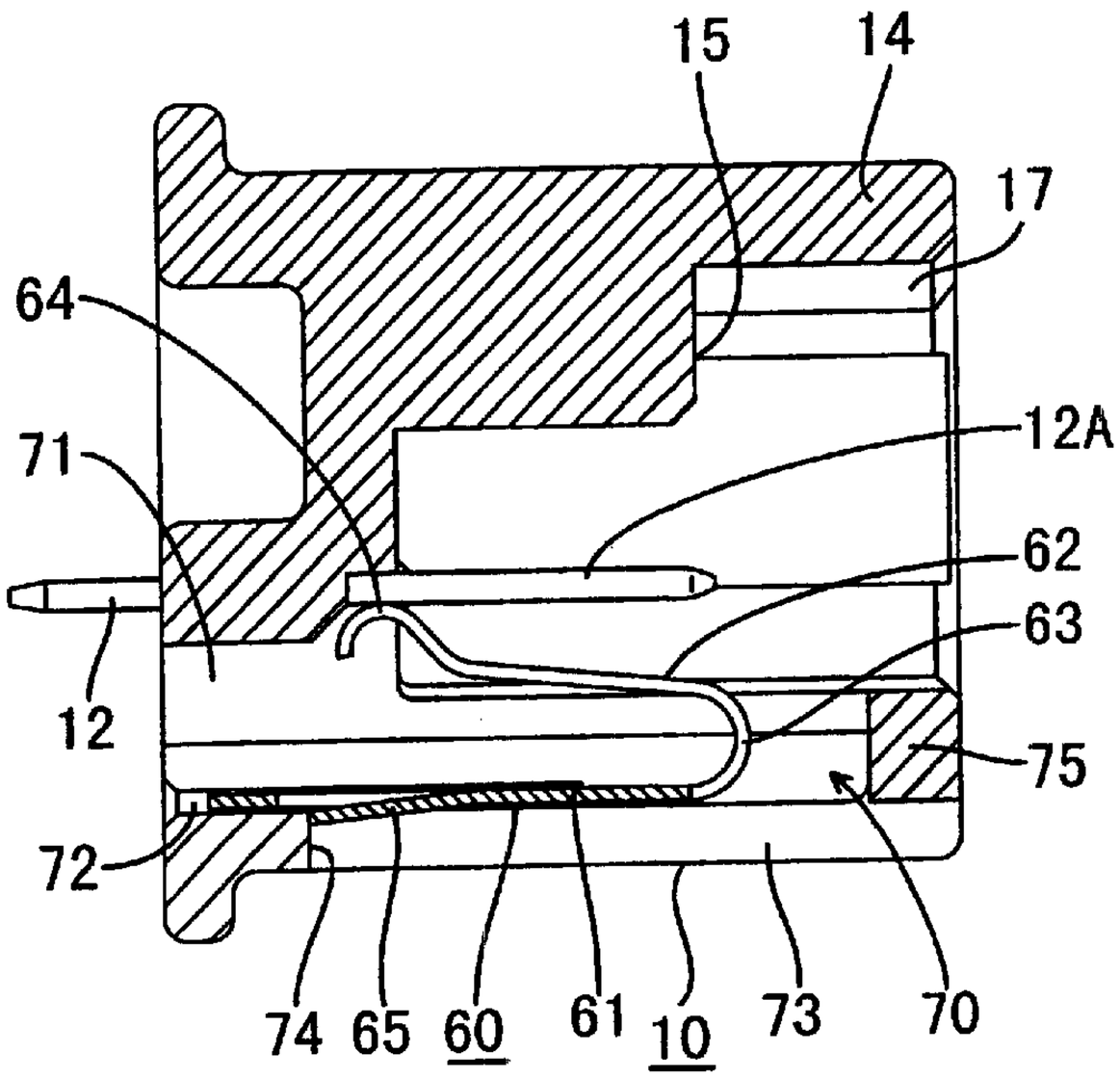

15
14
17
64
71
12A
62
63
12
75
72
74
65
60
61
10
73
70

Fig7

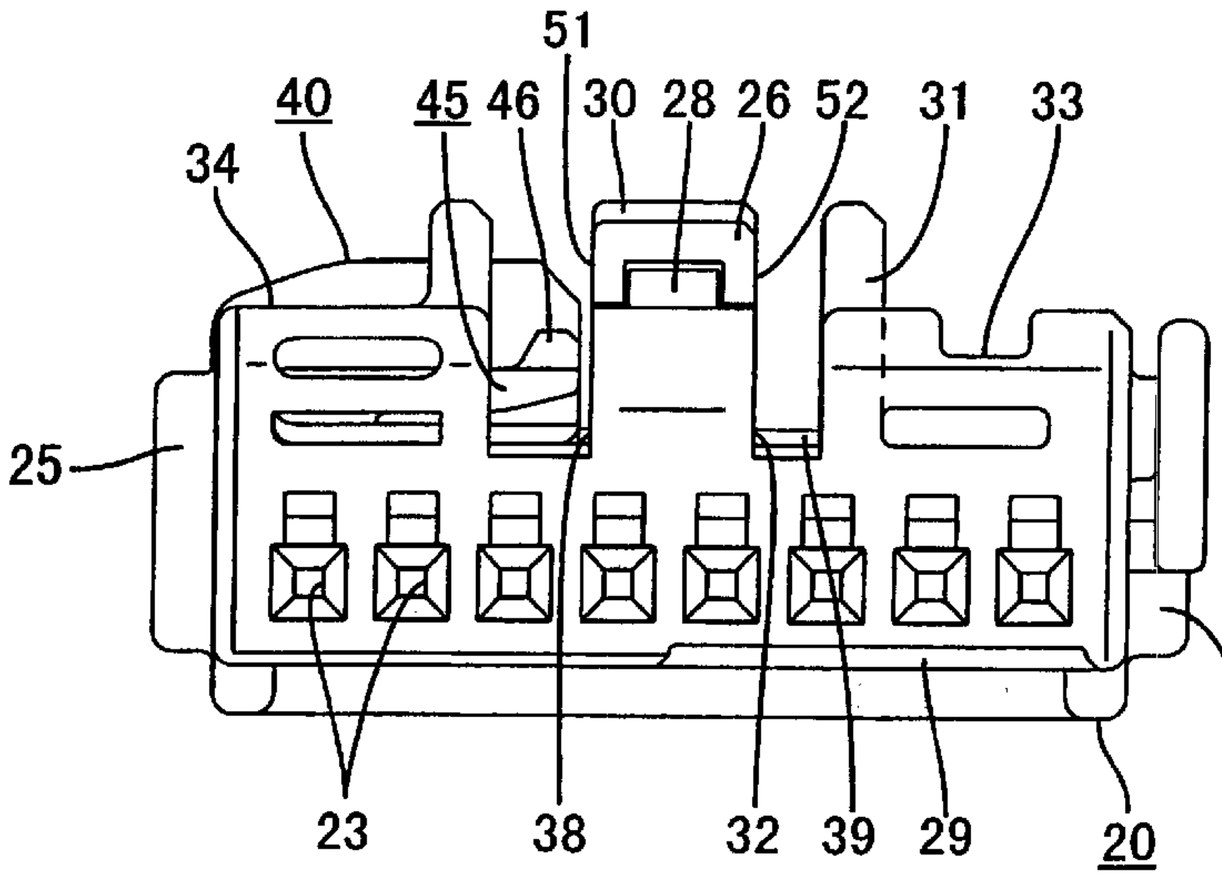


Fig 8

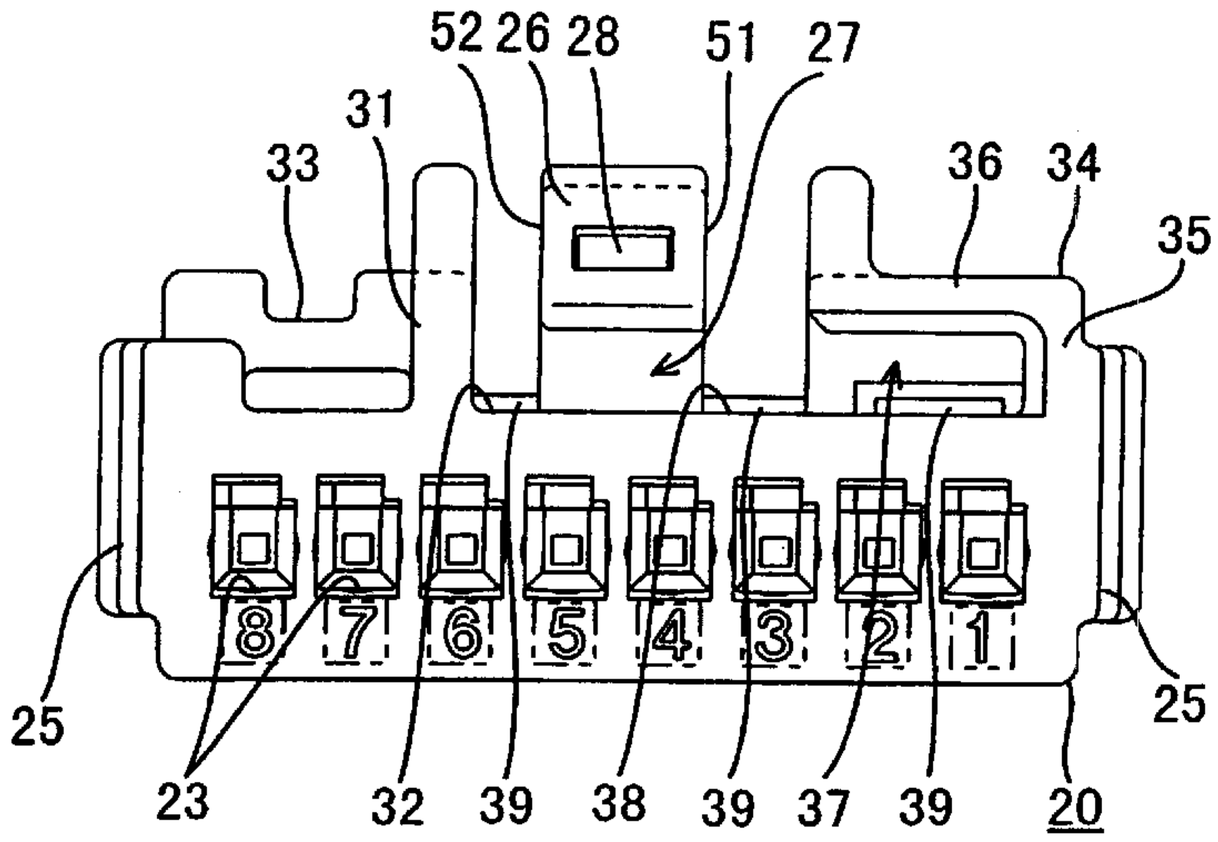


Fig 9

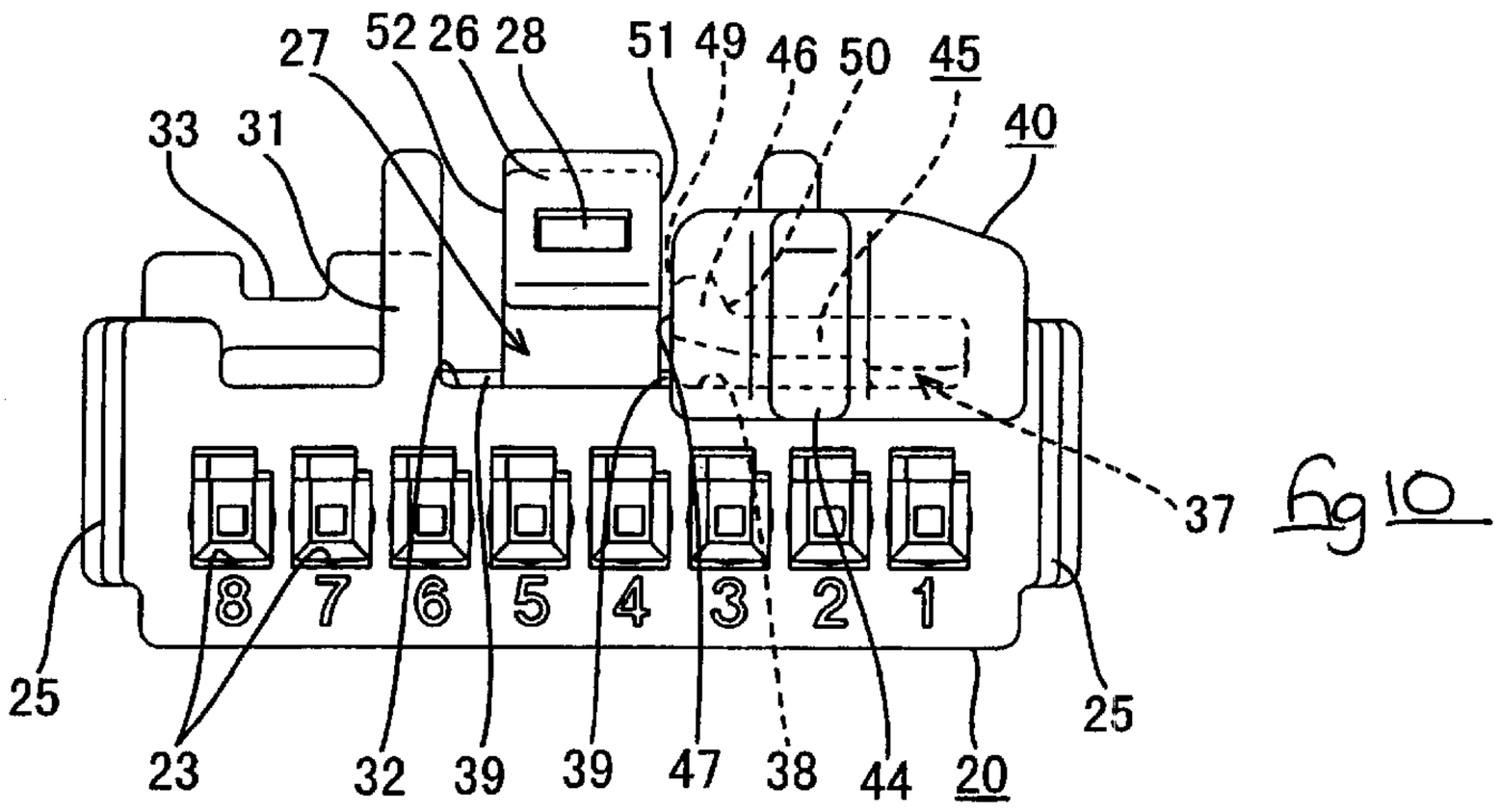
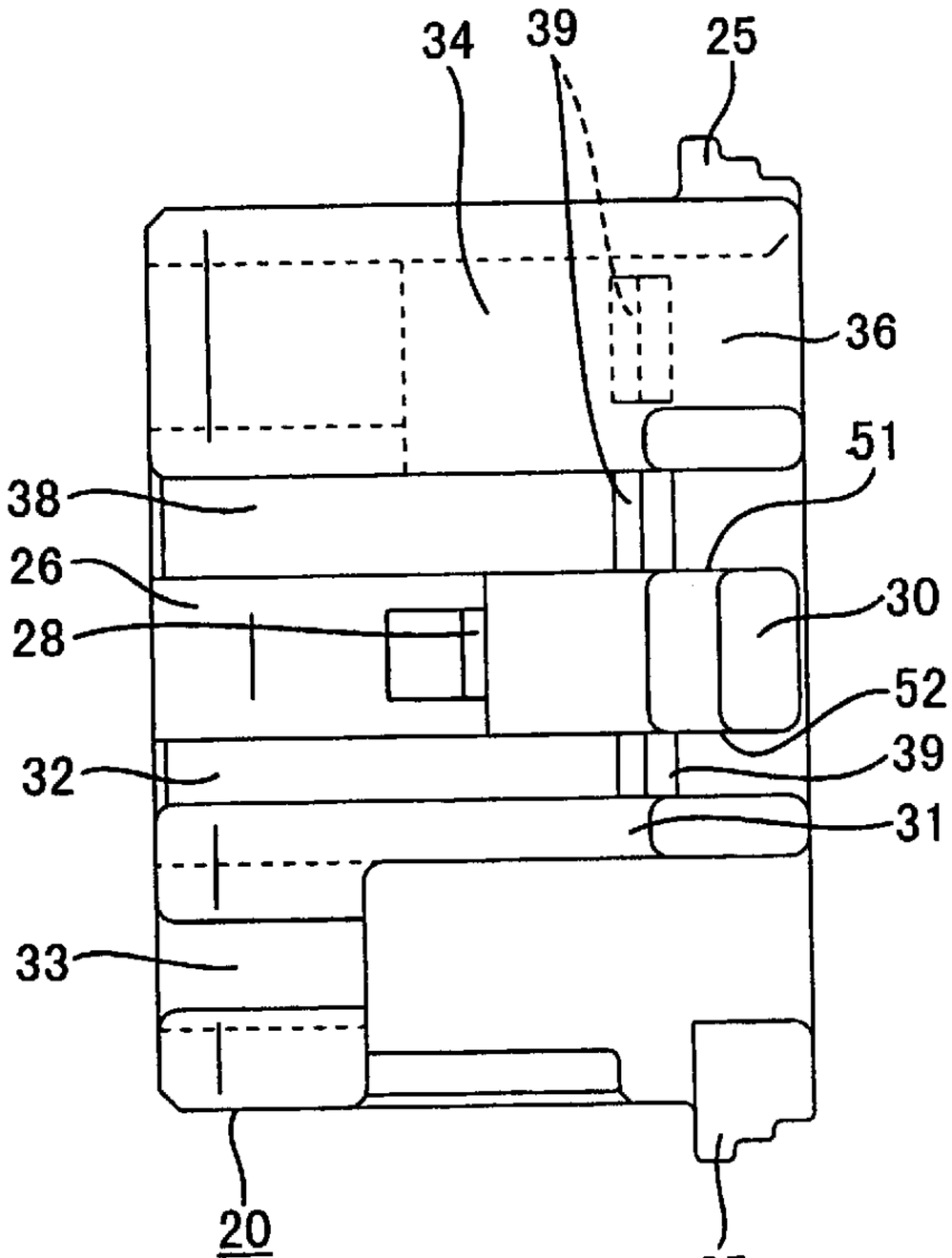


Fig 10


34
39
25
36
51
38
26
28
30
52
39
32
31
33
20
25

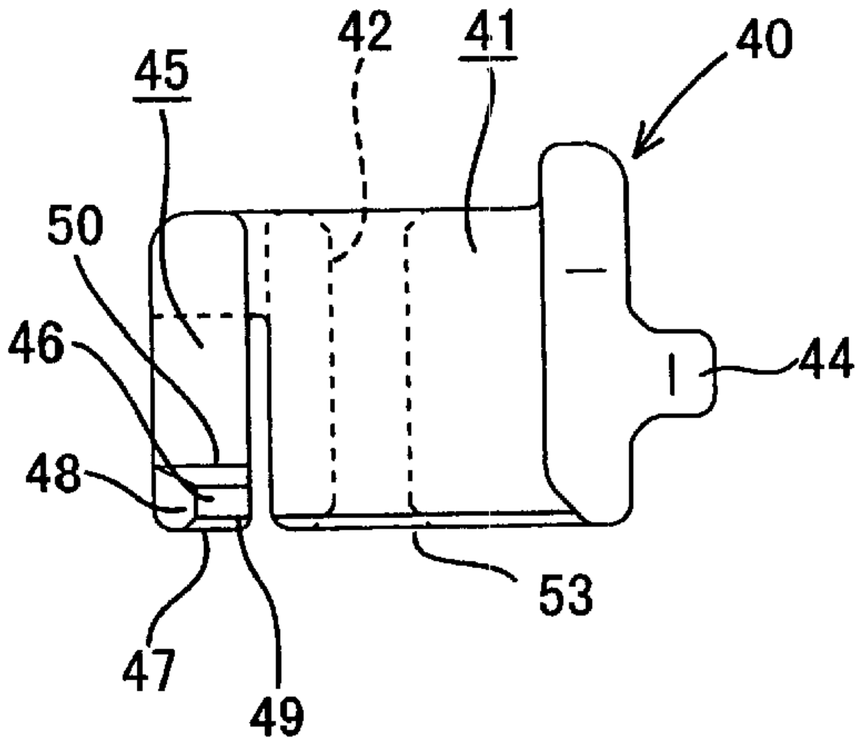

45
42
41
40
50
46
44
48
53
47
49

Fig 11

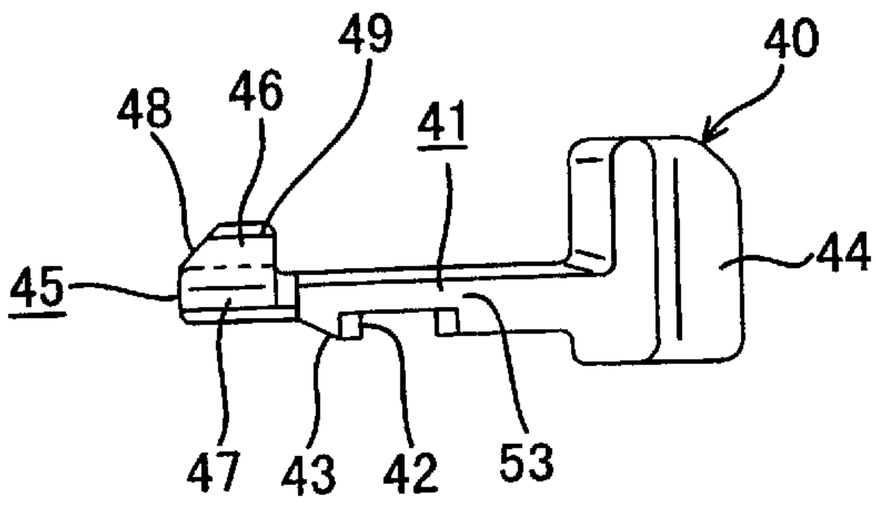

49
40
48
46
41
45
44
47
43
42
53

Fig 12

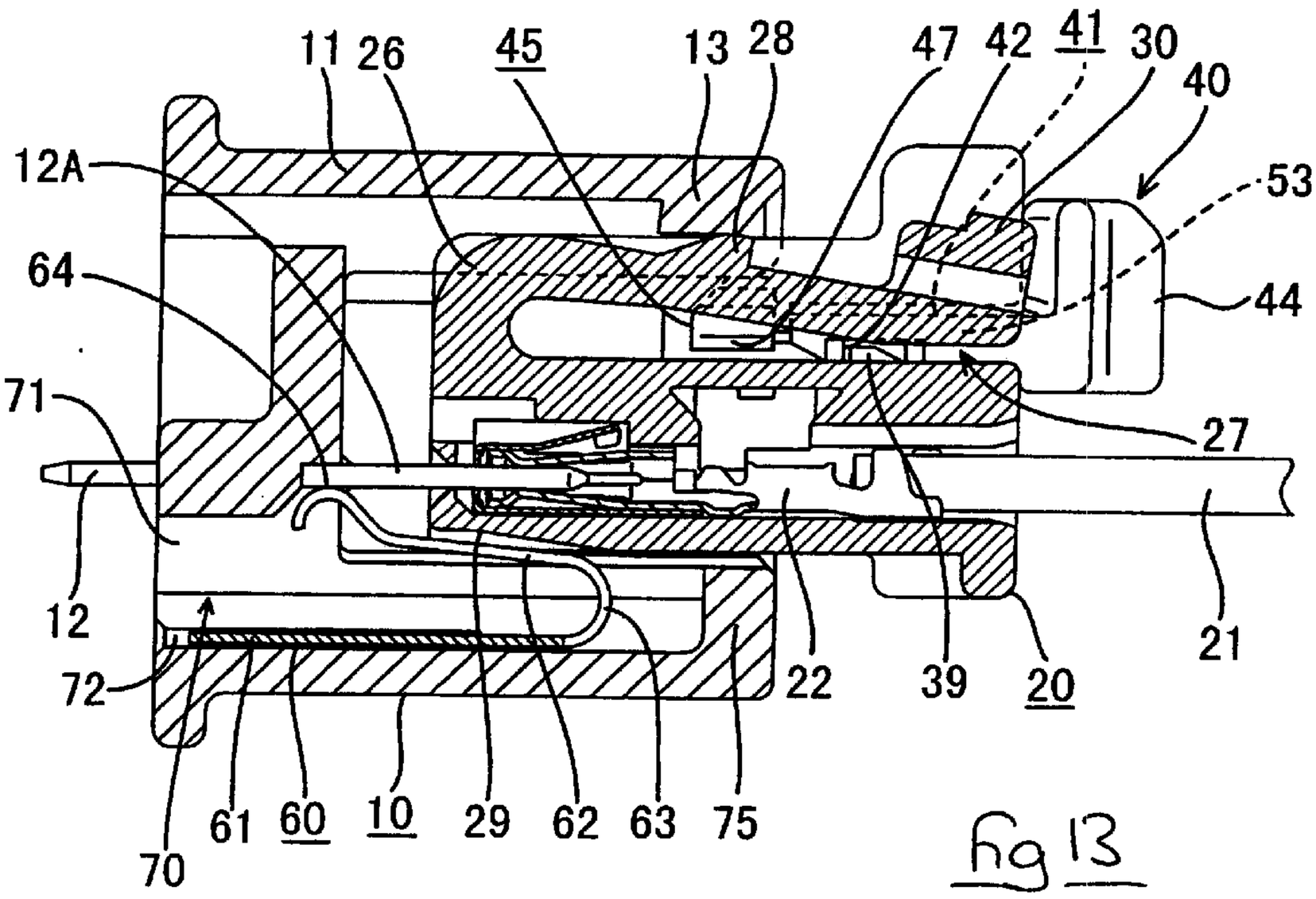

11
26
45
13
28
47
42
41
30
40
53
12A
64
44
71
27
12
72
22
39
20
21
70
61
60
10
29
62
63
75

Fig 13

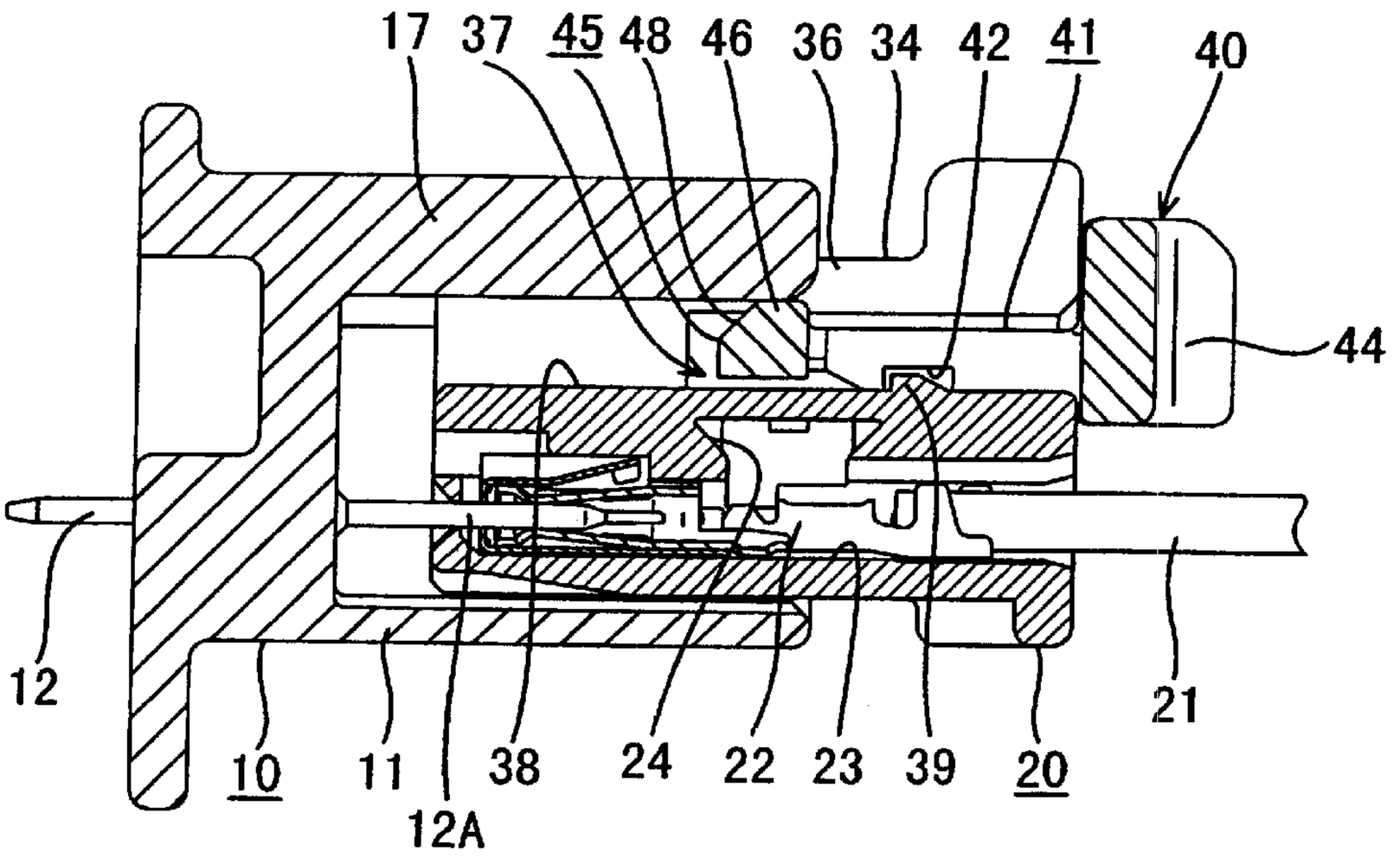

17
37
45
48
46
36
34
42
41
40
44
12
21
10
11
38
24
22
23
39
20
12A

Fig 14

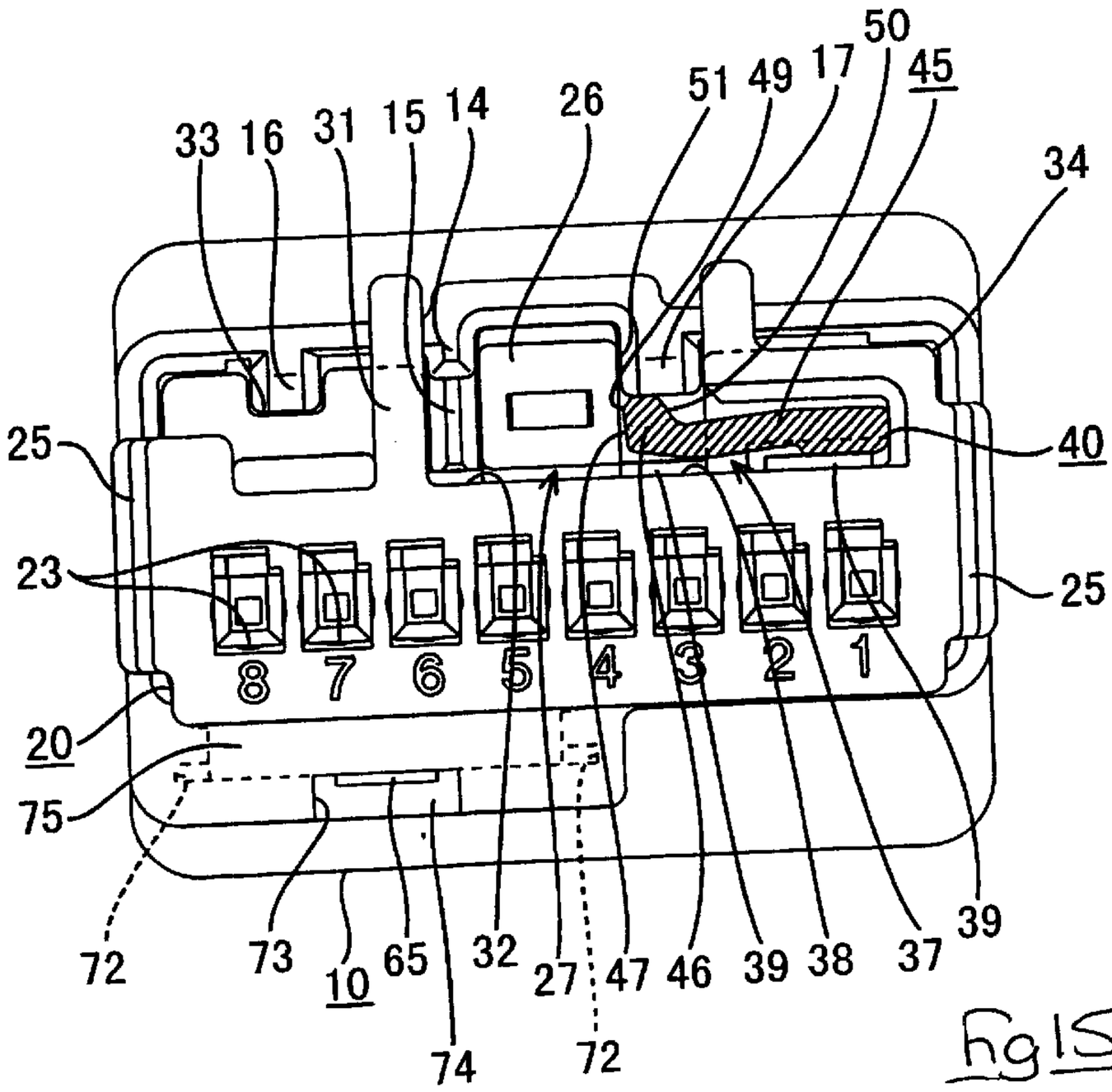

33
16
31
15
14
26
51
49
17
50
45
34
25
40
23
8
7
6
5
4
3
2
1
25
20
75
72
73
10
65
74
32
27
72
47
46
39
38
37
39

Fig 15

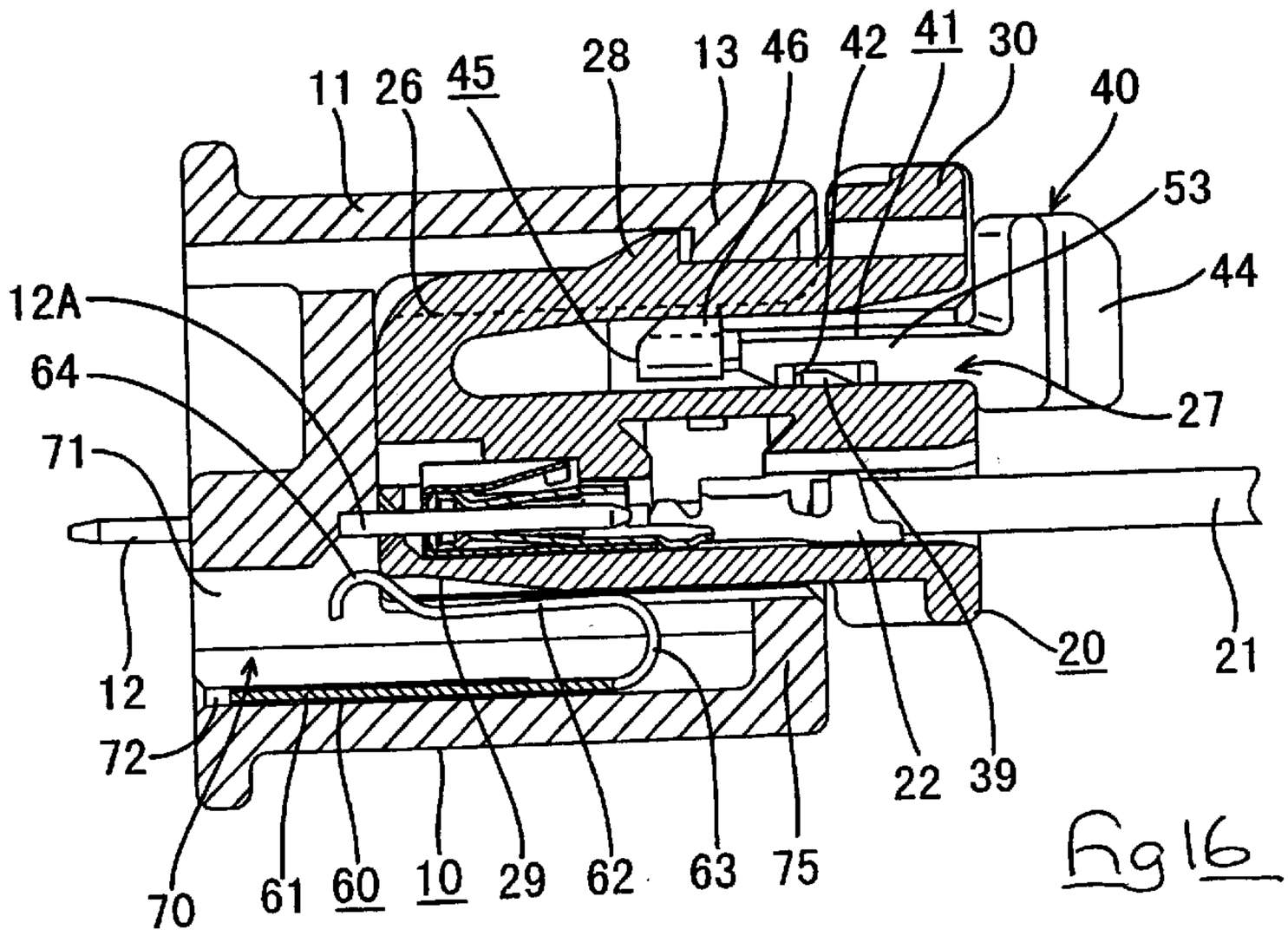

11
26
45
28
13
46
42
41
30
40
53
44
12A
64
27
71
20
21
12
72
22
39
70
61
60
10
29
62
63
75

Fig 16

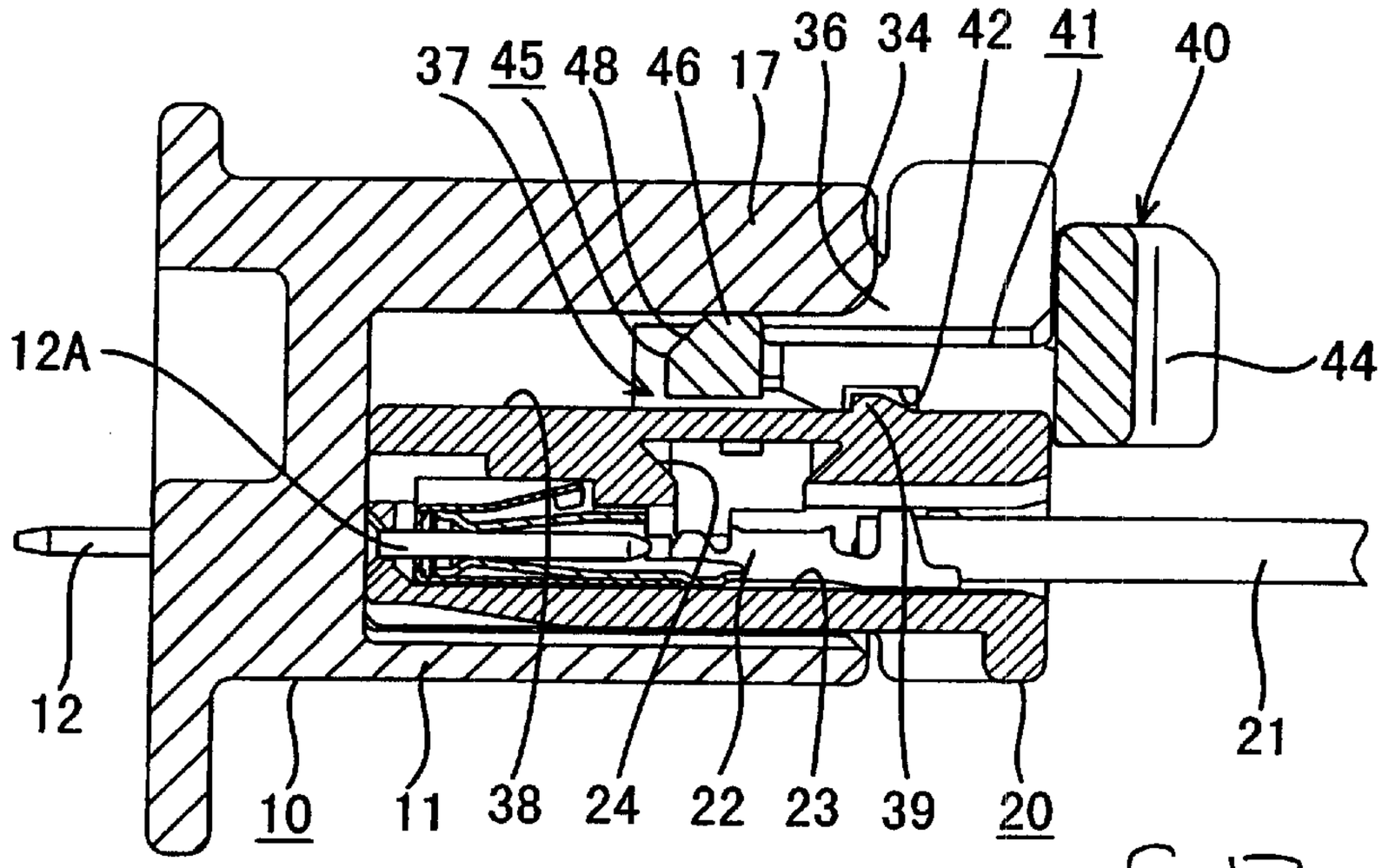

37
45
48
46
17
36
34
42
41
40
12A
44
12
21
10
11
38
24
22
23
39
20

Fig 17

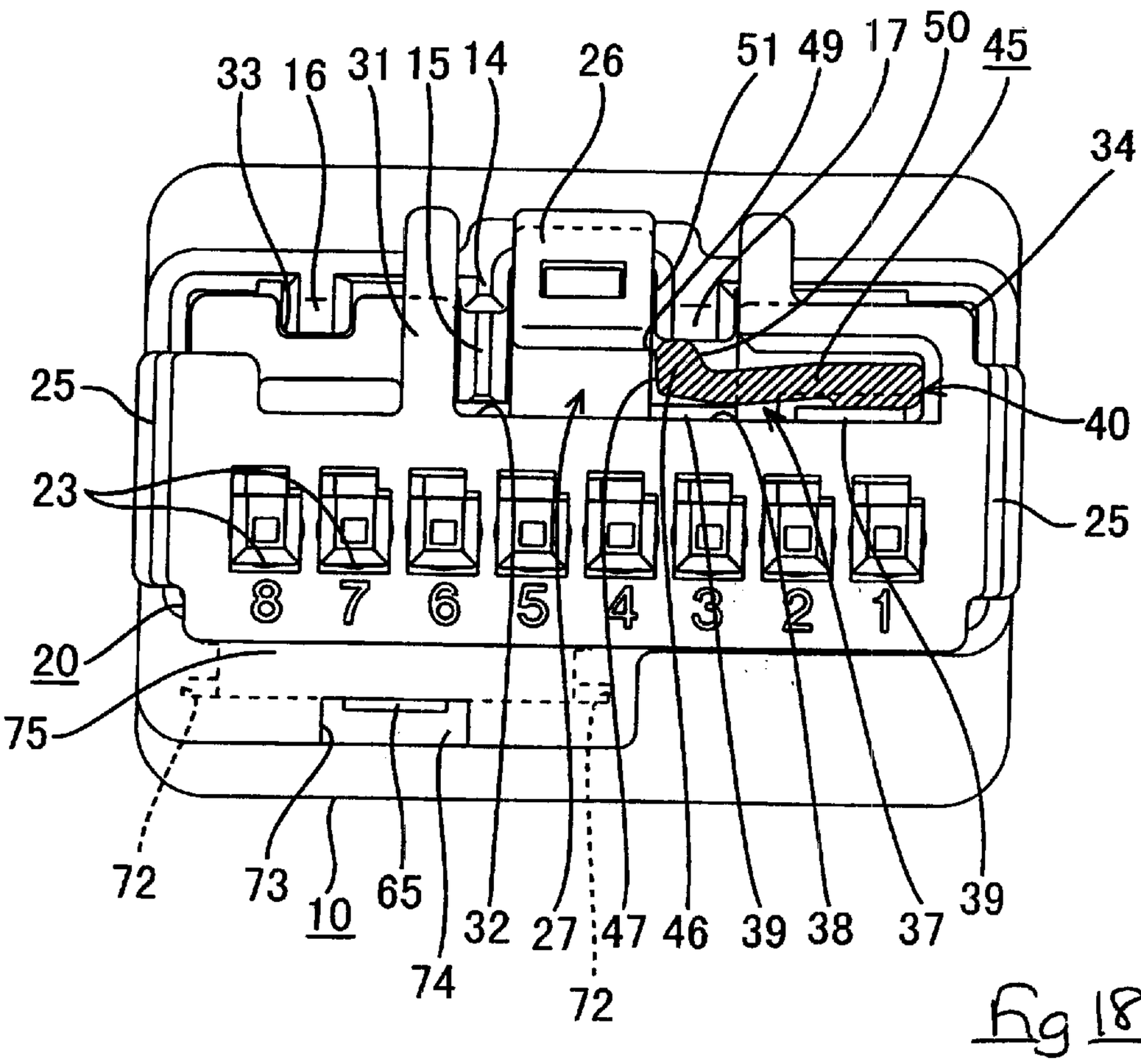

33
16
31
15
14
26
51
49
17
50
45
34
25
40
23
25
8
7
6
5
4
3
2
1
20
75
72
73
10
65
74
32
27
72
47
46
39
38
37
39

Fig 18

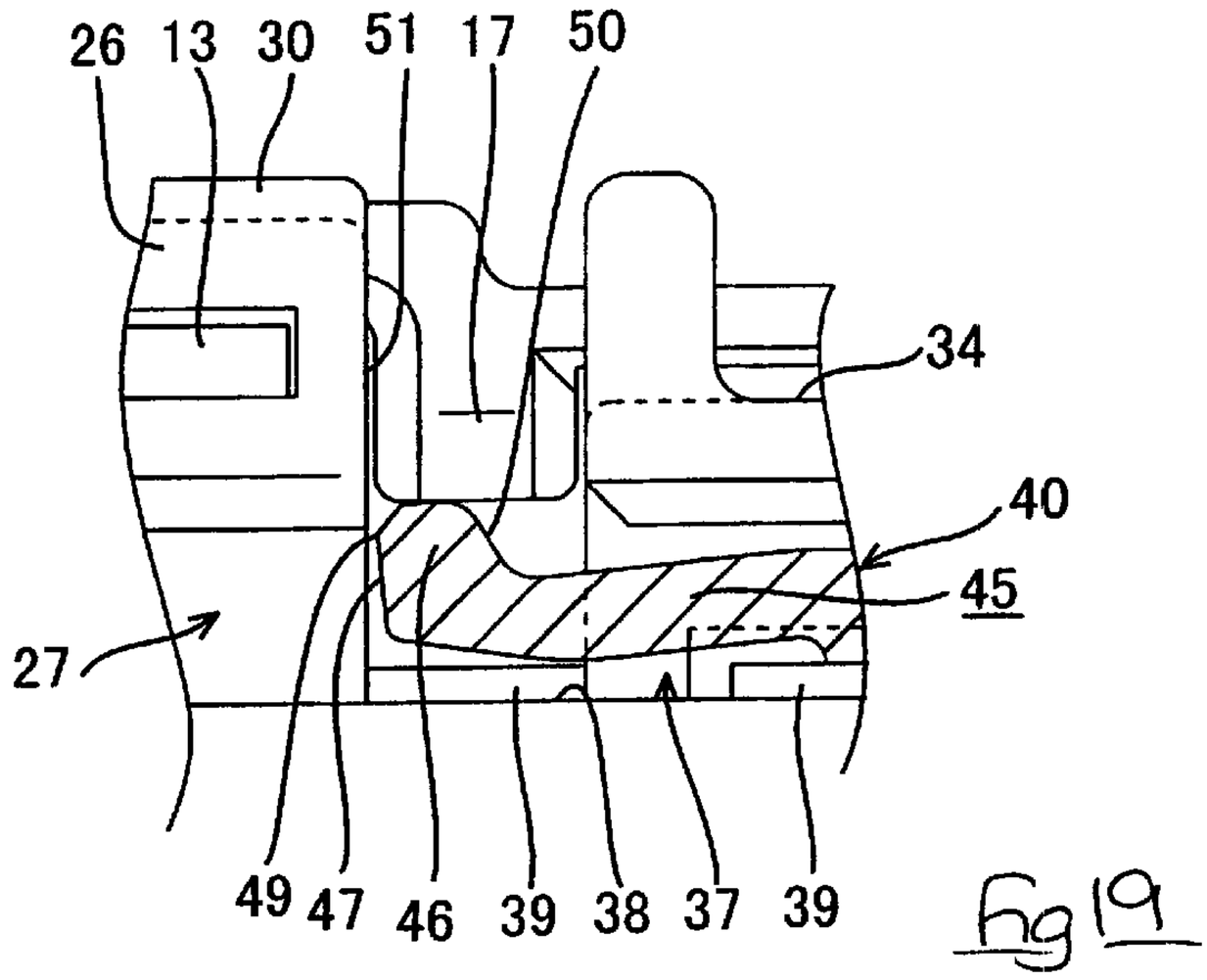

26
13
30
51
17
50
34
40
45
27
49
47
46
39
38
37
39

Fig 19

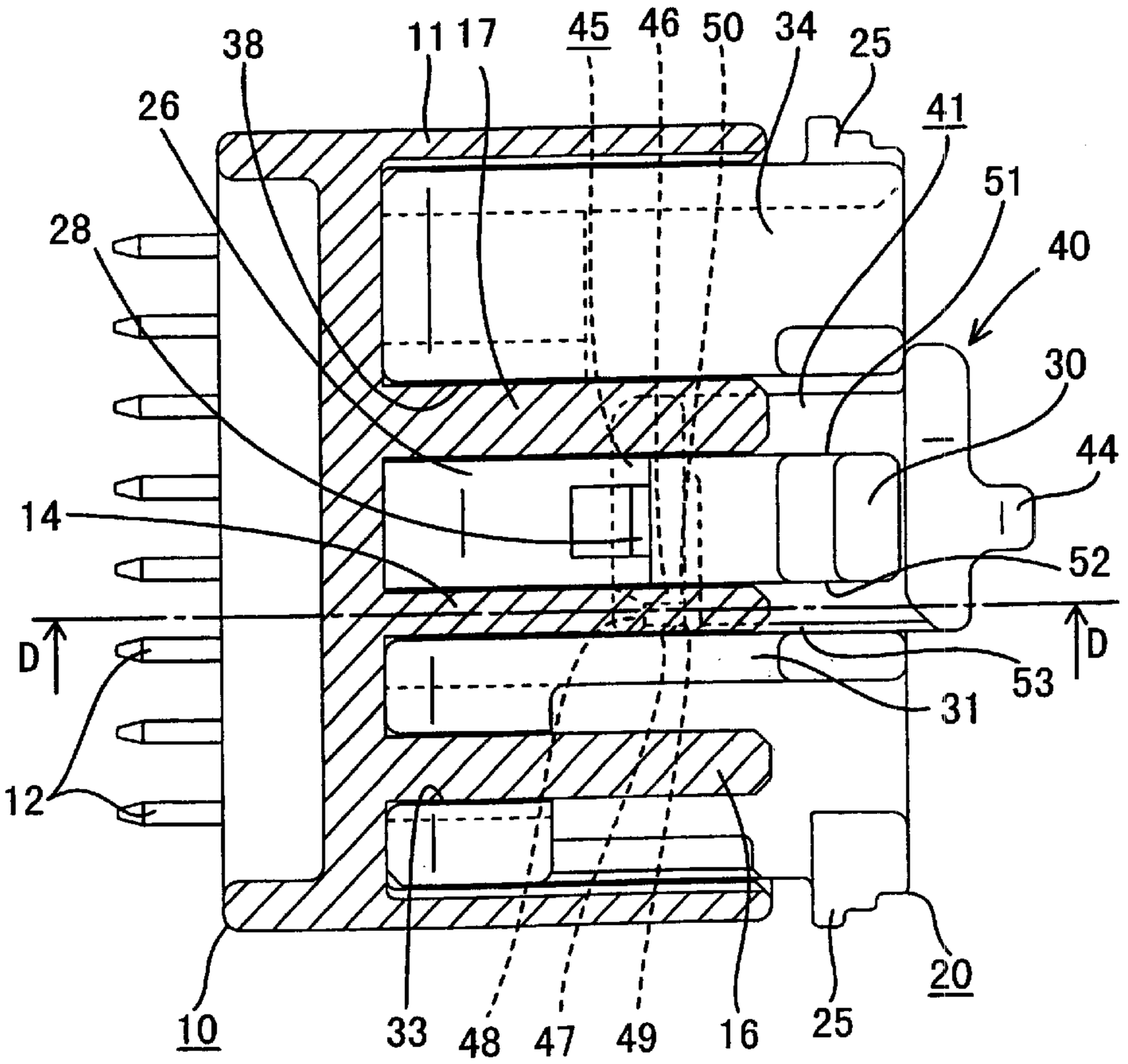

38
11
17
45
46
50
34
25
26
41
51
28
40
30
44
14
52
D
D
53
31
12
10
33
48
47
49
16
25
20

Fig 20

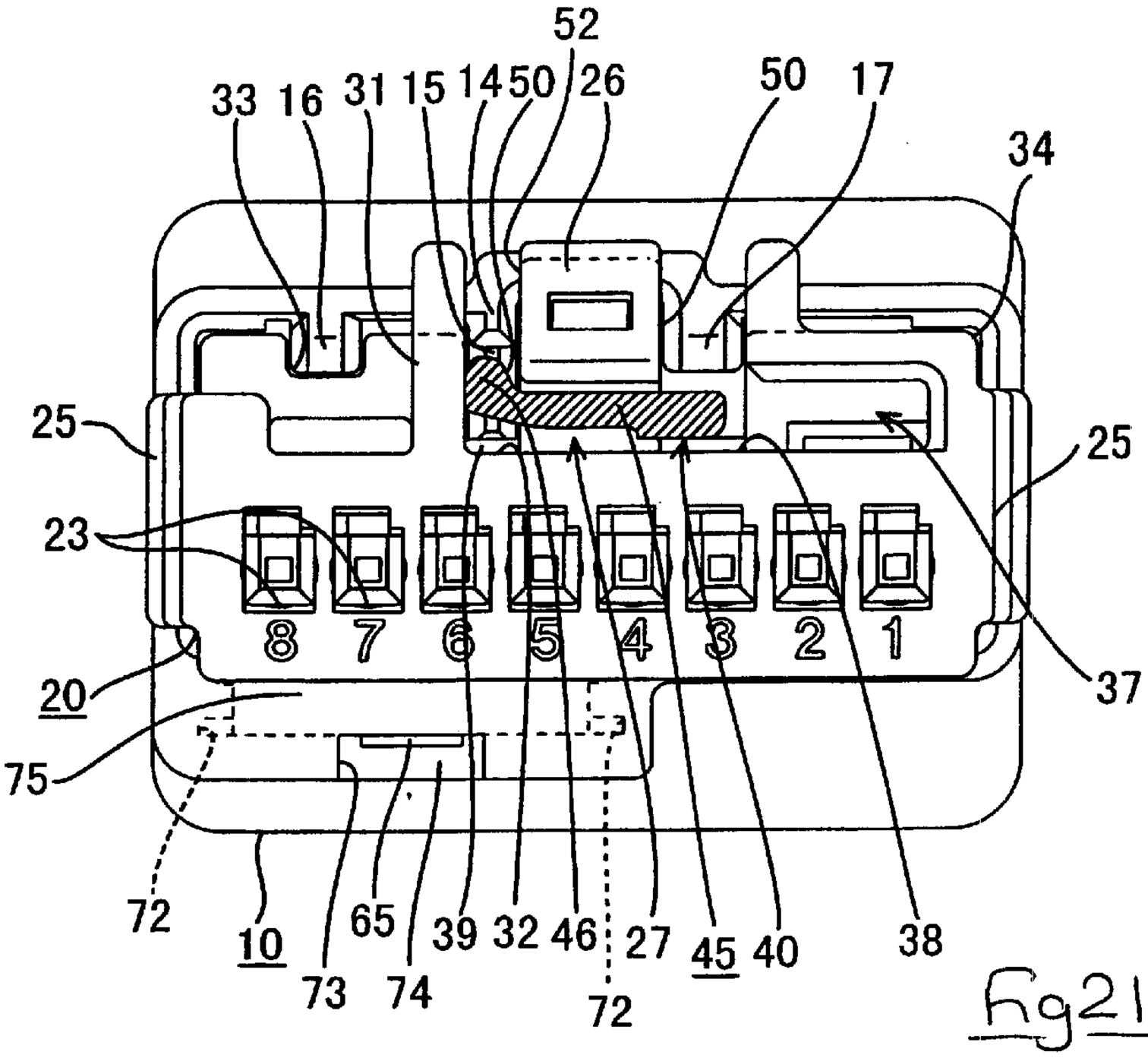

52
33
16
31
15
14
50
26
50
17
34
25
25
23
8
7
6
5
4
3
2
1
20
37
75
72
10
65
39
32
46
27
45
40
38
73
74
72

Fig21

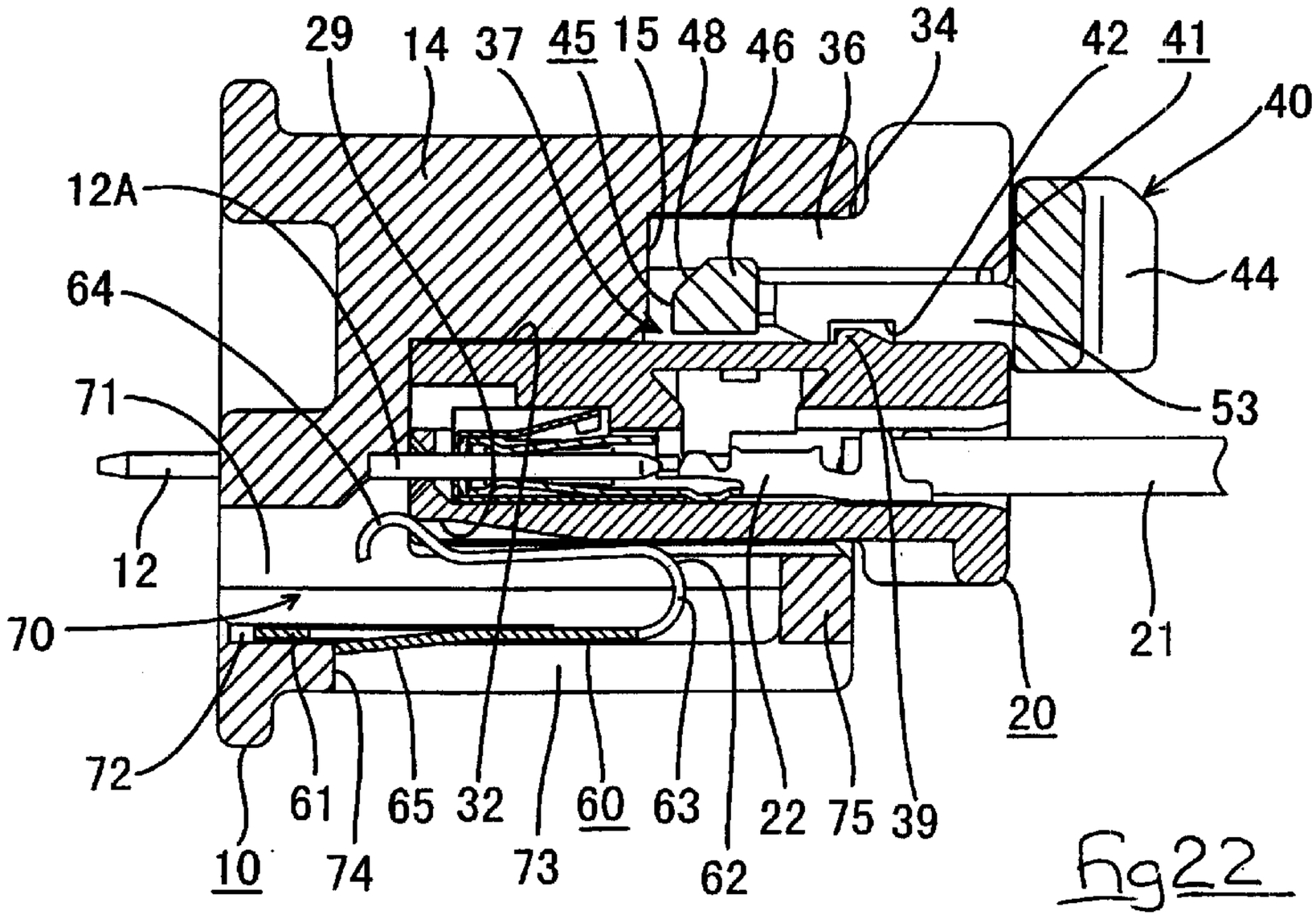
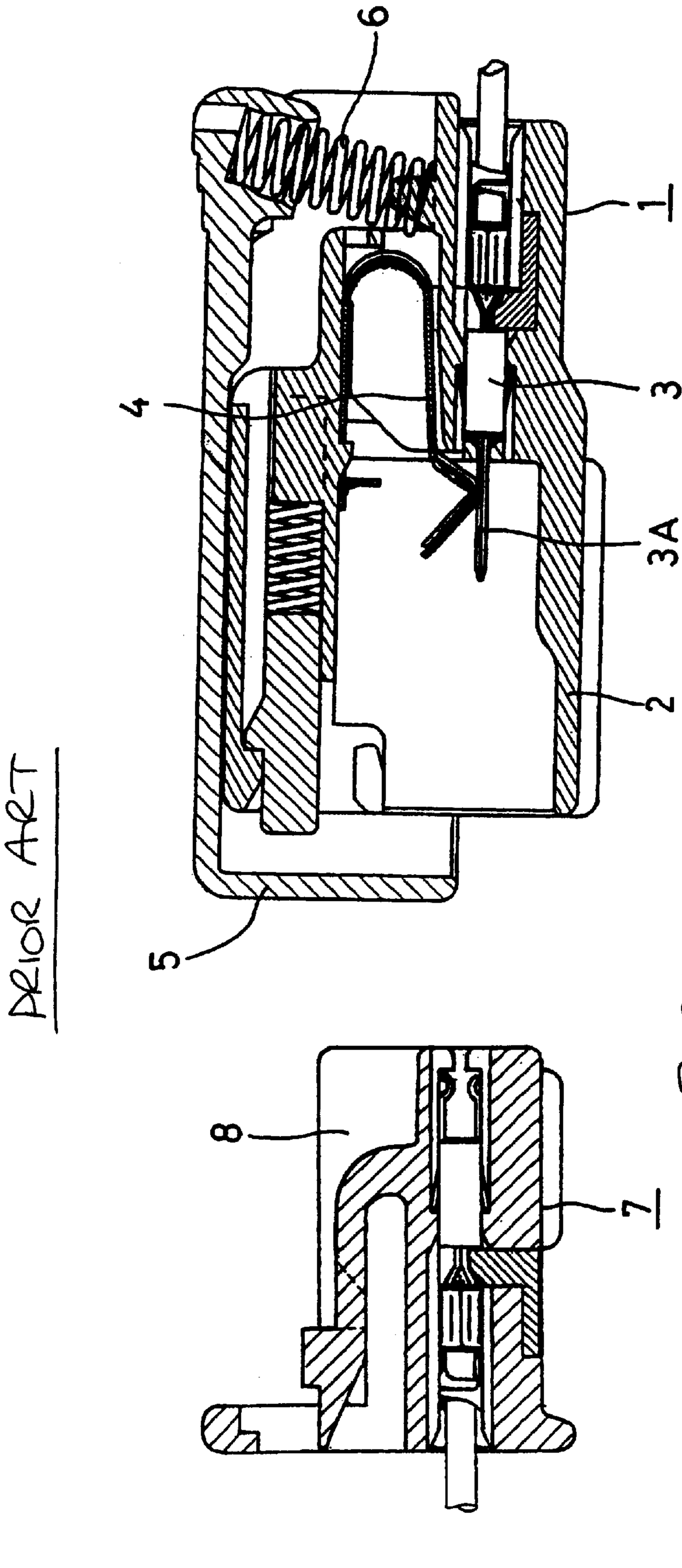

29
14
37
45
15
48
46
36
34
42
41
40
12A
64
71
44
53
12
70
21
20
72
61
65
32
60
63
22
75
39
10
74
73
62

Fig22



PRIOR ART

Fig 2

CONNECTOR WITH SHORTING TERMINAL

TECHNICAL FIELD

The present invention relates to an electrical connector provided with a shorting terminal.

BACKGROUND TO THE INVENTION

One example of a connector provided with a shorting terminal is described in JP-11-329604. As shown in FIG. **23** of this specification, a connector has a female housing **7** capable of being fitted into a hood **2** of a male housing **1**. A plurality of male terminal fittings **3** protrude into the hood, and a shorting terminal **4** is attached to this hood **2**, the shorting terminal **4** connecting a plurality of tabs **3**A of the male terminal fittings **3**, thereby short-circuiting these male terminal fittings **3**. As the two housings **1** and **7** are fitted together, an outer face of the female housing **7** makes contact with the shorting terminal **4**. As the fitting progresses, the female housing **7** releases the short-circuiting state of the shorting terminal **4** with the male terminal fittings **3**.

In this connector, the shorting terminal **4** is provided in a location where the opening area of the hood **2** of the male housing **1** is greater than the area of a fitting end face of the female housing **7**. The entirety of the shorting terminal **4** protrudes towards the exterior of the opening of the hood **2**. Consequently, a protecting cover **5** capable of being rocked open and closed is attached resiliently by a spring **6** to an outer face of the male housing **1**, this protecting cover **5** covering the open portion of the hood **2** and protecting the shorting terminal **4**. A misalignment preventing rib **8** protrudes from an upper face of the female housing **7**, this misalignment preventing rib **8** preventing the female housing **7** from being inserted in an inclined state into the hood **2** when the two housings **1** and **7** are fitted together.

In this connector, the misalignment preventing rib **8** is provided on the female housing **7** and the protecting cover **5** is provided on the male housing **1**. As a result, the connector has a complex configuration. In particular, the attachment device of the protecting cover **5** requires the spring **6** and other components, and the number of components becomes large. Simplifying this configuration would be desirable.

Furthermore, a jig is used to attach the shorting terminal **4** within the male housing **1** from the anterior via the opening portion of the hood **2**. However, the tabs **3**A of the male terminal fittings **3** protrude from the innermost portion of the hood **2**. Consequently, the jig may interfere with these tabs **3**A of the male terminal fittings **3** when the shorting terminal **4** is being attached, thus bending the male terminal fittings **3** in an undesirable manner.

The present invention has taken the above problems into consideration, and aims to rectify them.

SUMMARY OF THE INVENTION

According to a first aspect of the invention there is provided an electrical connector comprising a first housing provided with a hood, and a second housing insertable in the hood in a fitting direction and to a fully fitted condition, said first housing having a plurality of terminal fittings protruding into said hood, and a resilient shorting terminal having one or more resilient contacts, said shorting terminal being in contact with two or more of said terminal fittings and adapted to be separated therefrom by said second housing on insertion to the fully fitted condition, wherein said first housing further includes a wall at the mouth of said hood and extending into said hood substantially transverse to said fitting direction, said wall overlapping said shorting terminal in a direction transverse to said fitting direction. Such a wall can avoid misalignment on insertion of the second housing into the hood, by making the hood aperture a close fit around the second housing. Furthermore the wall protects the shorting terminal from inadvertent damage, for example during transit.

According to a second aspect of the invention there is provided an electrical connector comprising a first housing provided with a hood, and a second housing insertable in the hood in a fitting direction and to a fully fitted condition, said first housing having a plurality of terminal fittings protruding into said hood, and a resilient shorting terminal having one or more resilient contacts, said shorting terminal being in contact with two or more of said terminal fittings and adapted to be separated therefrom by said second housing on insertion to the fully fitted condition wherein said first housing includes an insertion aperture for said shorting terminal, said aperture facing outwards in the opposite direction to said hood.

Insertion of the shorting terminal from the rear side ensures that inadvertent damage to the terminal fittings is avoided.

BRIEF DESCRIPTION OF DRAWINGS

Other features of the invention will be apparent from the following description of a preferred embodiment shown by way of example only in the accompanying drawings in which:

FIG. **1** is a partially cut-away plan view of an embodiment of the present invention, showing a connector prior to fitting.

FIG. **2** is a cross-sectional view along the line A—A of FIG. **1**.

FIG. **3** is a cross-sectional view along the line B—B of FIG. **1**.

FIG. **4** is a front view of a male housing.

FIG. **5** is a rear face view of the male housing.

FIG. **6** is a cross-sectional view along the line C—C of FIG. **4** showing the attachment operation of a shorting terminal.

FIG. **7** is a cross-sectional view along the line C—C of FIG. **4**.

FIG. **8** is a front view of a female housing.

FIG. **9** is a rear face view of the female housing.

FIG. **10** is a rear face view of the female housing showing a detecting member in an attached state.

FIG. **11** is a plan view of the female housing and the detecting member.

FIG. **12** is a front view of the detecting member.

FIG. **13** is a cross-sectional view showing the two housings of FIG. **2** being fitted together.

FIG. **14** is a cross-sectional view showing the two housings of FIG. **3** being fitted together.

FIG. **15** is a partially cut-away rear face view showing the two housings being fitted together.

FIG. **16** is a cross-sectional view showing the two housings of FIG. **2** fitted together.

FIG. **17** is a cross-sectional view showing the two housings of FIG. **3** fitted together.

FIG. **18** is a partially cut-away rear face view showing the two housings fitted together.

FIG. **19** is a partially cut-away expanded rear face view showing the detecting member and a side face of a locking arm in a catching state.

FIG. **20** is a partially cut-away plan view showing the detecting member in a state whereby it has been moved.

FIG. **21** is a partially cut-away rear face view showing the detecting member in the state whereby it has been moved.

FIG. **22** is a cross-sectional view along the line D—D of FIG. **20**.

FIG. **23** is a side cross-sectional view of a prior art example.

DESCRIPTION OF PREFERRED EMBODIMENT

An embodiment of the present invention is described below with the aid of FIGS. **1** to **22**. As shown in FIG. **2**, a connector of the present embodiment has a female connector housing **20** that fits into a hood **11** provided on a male connector housing **10**. A shorting terminal **60** is attached to the male housing **10**, and a detecting member **40** is attached to the female housing **20**. The fitting face sides of the two housings **10** and **20** are considered as the anterior sides.

As shown in FIGS. **1** and **2**, the cylindrical hood **11** is provided on an anterior portion of the male housing **10**. This hood **11** is open to the anterior, and the female housing **20** can be fitted therein. Eight male terminal fittings **12** (these being tab shaped at both ends) are aligned in a widthwise direction within the male housing **10**. Anterior portions **12**A of these male terminal fittings **12** protrude into the hood **11**, and posterior portions thereof are located to the outer posterior portion of the male housing **10**. A left half (relative to FIG. **4**) of a lower portion of the hood **11** protrudes downwards, this protruding portion being provided with a shorting terminal housing recess **70** for housing the shorting terminal **60**. The shorting terminal **60** is capable of making contact with the anterior portions **12**A of four of the male terminal fittings **12** protruding into the hood **11** (these four male terminal fittings **12** being located at the left side), thereby short-circuiting these male terminal fittings **12**. The configuration of the shorting terminal **60** and the shorting terminal housing recess **70** will be described later.

As shown in FIG. **2**, a locking claw **13** protrudes downwards from a central portion of an upper face of the hood **11**, this locking claw **13** engaging with a locking arm **26** of the female housing **20**. The left side (relative to FIG. **4**) of the locking claw **13** has a guiding rib **14** protruding downwards therefrom, and a releasing rib **17** protrudes downwards from the right side of the locking claw **13**. As shown in FIG. **1**, anterior end faces of the guiding rib **14** and the releasing rib **17** are even with an anterior end face of the hood **11**.

The fitting operation of the two housings **10** and **20** is guided by the guiding rib **14** fitting into a guiding groove **32** formed in the female housing **20**. As shown in FIG. **7**, a block-like cut-away portion **15** having a specified size is formed at a lower portion of an anterior end of the guiding rib **14**. As shown in FIG. **4**, a guiding rib **16** is provided somewhat to the left of the guiding rib **14** and is separated from it by a space. It has the same function as the guiding rib **14**, but differs from the guiding rib **14** in that it does not have a cut-away portion **15** provided thereon.

As shown in FIG. **1**, the releasing rib **17** is capable of fitting into a recess **38** formed in the female housing **20**. When the releasing rib **17** is inserted into the recess **38**, this releasing rib **17** engages with a stopper arm **45** of the detecting member **40** that is located so as to protrude into the recess **38** (see FIG. **14**). Like the guiding ribs **14** and **16**, the releasing rib **17** also has a guiding function.

As shown in FIG. **8**, the female housing **20** is approximately block-like, and can be fitted into the hood **11** of the male housing **10**. As shown in FIG. **4**, the area labelled with the letter R forms a fitting area R of the female housing **20** relative to the hood **11**. As shown in FIGS. **2** and **8**, eight cavities **23** are formed in the female housing **20**, these corresponding in location to the male terminal fittings **12** and being capable of housing female terminal fittings **22** that are joined to the ends of electric wires **21**. Through holes **24** intersect with each of the cavities **23** within the female housing **20**, a retainer (not shown) being attached via these through holes **24** and maintaining the female terminal fittings **22** in an unremovable state. As shown in FIG. **8**, a tapered contact releasing member **29** is formed at a right half of a lower face of an anterior portion of the female housing **20**. This contact releasing member **29** makes contact with resilient contacts **62** of the shorting terminal **60** (to be described). A pair of fitting operating members **25** protrude from both side faces of the female housing **20**. These are used to perform the fitting operation of the female housing **20** and the male housing **10**.

As shown in FIGS. **1** and **2**, the cantilevered locking arm **26** is provided at a central portion of an upper face of the female housing **20**. This locking arm **26** extends along the fitting direction of the two housings **10** and **20**, a base end thereof being formed at an anterior end portion of the female housing **20**, and a free end thereof extending towards the posterior. A posterior end face of the locking arm **26** is even with a posterior end face of the female housing **20**. From its free state, the locking arm **26** can be bent in an up-down direction, the base end serving as its fulcrum, and entering a bending space **27** formed below this locking arm **26**.

A locking protrusion **28** is formed at an approximately central location (relative to the lengthwise direction) of an upper face of the locking arm **26**. This locking protrusion **28** engages with the locking claw **13** of the male housing **10**. As shown in FIG. **13**, while the two housings **10** and **20** are being fitted together, a tapered face formed at an anterior end face of the locking protrusion **28** makes contact with the locking claw **13**, this causing the locking arm **26** to bend downwards. As shown in FIG. **16**, when the fitting operation is completed, the locking protrusion **28** catches with the locking claw **13**, thereby maintaining the two housings **10** and **20** in a fitted state. An upper face of the free end of the locking arm **26** has a pushing operating member **30** protruding therefrom. Pushing this pushing operating member **30** causes the locking arm **26** to bend.

A side wall **31** is provided to the left side (relative to FIG. **9**) of the locking arm **26**, being separated by a specified distance therefrom. The space between the locking arm **26** and the side wall **31** forms the guiding groove **32** into which the guiding rib **14** of the male housing **10** fits. A guiding groove **33** is formed to the left of the side wall **31**, the guiding rib **16** of the male housing **10** fitting therein.

A surrounding wall **34** is formed at the right side (relative to FIG. **9**) of the locking arm **26**, being separated by a specified distance therefrom. The space between the locking arm **26** and the surrounding wall **34** forms the recess **38**, the releasing rib **17** of the male housing **10** fitting therein. The surrounding wall **34** is provided with a base member **35** at the right side of the female housing **20**. The surrounding wall **34** extends upwards to a specified height from the base member **35**, and then bends over at an approximate right angle towards the left to form a ceiling member **36**, thereby having a cross-sectionally L-shape. As shown in FIG. **10**, the space between the base member **35** and the ceiling member **36** forms a housing space **37** within which the detecting member **40** can be attached.

As shown in FIGS. **9** and **11**, the upper face of the female housing **20**, which has the guiding groove **32**, the recess **38**, and the housing space **37** provided thereon, is provided with a protruding member **39** extending along a widthwise direction thereof. This protruding member **39** is divided into three portions that are formed along a straight line.

As shown in FIG. **1**, after the detecting member **40** has been attached to the female housing **20**, it is located so as to straddle the housing space **37** and the recess **38**, and is capable of moving in the widthwise direction of the female housing **20**, that is, in a direction intersecting with the fitting direction of the two housings **10** and **20**. As shown in FIG. **20**, after the detecting member **40** has been moved, it is located so as to extend from the recess **38** to the guiding groove **32**.

As shown in FIGS. **1** and **11**, the detecting member **40** has a plate-like main body **41** that extends across the upper face of the female housing **20**. The stopper arm **45** is formed at an anterior side of this main body **41**, and an operating member **44** is formed at a posterior side thereof. As shown in FIGS. **11** and **12**, a groove **42** extends along a lower face of the main body **41**, this extending in the widthwise direction of the female housing **20**, that is, in the direction of movement of the detecting member **40**. The protruding member **39** provided on the upper face of the female housing **20** fits into this groove **42**. A tapered face **43** is formed at an anterior portion of a lower face of the groove **42**. When the detecting member **40** is to be attached to the female housing **20**, this tapered face **43** allows the main body **41** to rise easily over the protruding member **39** (see FIG. **3**). The fitting together of the groove **42** and the protruding member **39** guides the detecting member **40** when it is being moved in the widthwise direction relative to the female housing **20**. Moreover, as shown in FIG. **3**, the fitting together of the groove **42** and the protruding member **39** prevents the detecting member **40** from moving to the anterior or the posterior.

As shown in FIG. **1**, when the detecting member **40** is in an attached state with the female housing **20**, the operating member **44** provided at the posterior of the main body **41** protrudes from the posterior end face of the female housing **20**, this allowing the operator to grip the operating member **44** and move the detecting member **40**.

As shown in FIGS. **11** and **12**, the stopper arm **45** at the anterior of the main body **41** is formed in a cantilevered shape, a base end thereof joining with the end portion of the main body **41** that is farthest from the locking arm **26**, and a free end thereof extending in the widthwise direction of the female housing **20** (the direction intersecting with the fitting direction of the two housings **10** and **20**). The free end of the stopper arm **45** is level with a side face **53** of the main body **41**, this side face **53** facing the locking arm **26**. The stopper arm **45** is capable of bending in the same direction as the stopper arm **26**, with the base end thereof serving as the fulcrum. As shown in FIG. **10**, when the detecting member **40** is in an attached state with the female housing **20**, an upper face of the stopper arm **45** is located somewhat below a lower face of the locking arm **26**. Further, as shown in FIG. **1**, the stopper arm **45** is located to the posterior relative to the locking protrusion **28** of the locking arm **26**.

As shown in FIG. **12**, a detecting protrusion **46** protrudes from an upper face of the free end of the stopper arm **45**. As shown in FIGS. **1** and **10**, when the detecting member **40** is in an attached state with the female housing **20**, the detecting protrusion **46** of the free end of the stopper arm **45** protrudes into the recess **38**. A left side face (relative to FIG. **10**) of the detecting protrusion **46** forms a contacting face **47** that makes contact with a right side face **51** of the locking arm **26**, this contact preventing the detecting member **40** from moving towards the left (relative to FIG. **10**). As shown in FIG. **12**, an anterior end face of the detecting protrusion **46** forms a guiding face **48** that is inclined upwards towards the posterior. As shown in FIG. **15**, the releasing rib **17** of the male housing **10** that is fitted into the concave member **38** engages with the guiding face **48**, thereby causing the stopper arm **45** to bend.

As shown in FIGS. **13** and **15**, the detecting member **40** makes contact with the bent locking arm **26** in the following manner: the contacting face **47** of the detecting protrusion **46** of the stopper arm **45** (this having been bent in the same direction as the locking arm **26**) makes contact with the side face **53** of the main body **41**, the contacting face **47** and the side face **53** forming a unified face.

As shown in FIG. **19**, the bent stopper arm **45** is maintained at a height, relative to the locking arm **26** which has returned to its original position, such that the stopper arm **45** can enter the bending space **27**. An upper corner **49** of the contacting face **47** of the detecting protrusion **46** catches slightly with the side face **51** of the locking arm **26**. In this state, the detecting member **40** cannot move unless a force that exceeds a specified force is exerted on the operating member **44**.

When the detecting member **40** has been moved to the position shown in FIG. **21**, the stopper arm **45** straddles the bending space **27** below the locking arm **26** and extends across the concave member **38** and the guiding groove **32**. As shown in FIG. **22**, the detecting protrusion **46** is located in the guiding groove **32** and is housed within the cut-away portion **15** of the guiding rib **14** of the male housing **10**. At this juncture, a right (relative to FIG. **21**) side face of the detecting protrusion **46** catches with a left side face **52** of the locking arm **26**, thereby preventing the detecting member **40** from moving towards the right. This right side face of the detecting protrusion **46** forms a catching member **50**.

Now the configuration of the shorting terminal **60** and the shorting terminal housing recess **70** (both of the male housing **10**) will be described (see FIGS. **4** and **7**).

As shown in FIG. **4**, the shorting terminal **60** is provided with a plate-shaped base member **61**. Four resilient contacts **62** are provided on an anterior end of this base member **61**. The pitch between each resilient contact **62** is the same as the pitch between the male terminal fittings **12**. As shown in FIG. **7**, base portions of the resilient contacts **62** are bent over towards the posterior in a U-shape, this forming bent portions **63** that comprise anterior ends of the shorting terminal **60**. After the bent portions **63** have been inclined so as to extend upwards, the free end portions of the resilient contacts **62** form an angled shape, the peaks thereof forming contacting members **64** that make contact with the tab-shaped anterior portions **12**A of the male terminal fittings **12** that protrude into the hood **11**. Bending the resilient contacts **62** downwards separates them from the male terminal fittings **12**. A stopping member **65** is formed by cutting away, in a downwards direction, a central portion (relative to the widthwise direction) of the base member **61**.

As shown in FIGS. **5** and **7**, a posterior end of the shorting terminal housing recess **70** is open to the posterior, forming an attachment hole **71**. As shown in FIG. **6**, the shorting terminal **60** is inserted from the posterior of the male housing **10** into the shorting terminal housing recess **70** via this attachment hole **71**. As shown in FIGS. **5** and **6**, a pair of attachment grooves **72** extend for a specified length along

a lower edge of the shorting terminal housing recess **70**, these attachment grooves **72** opening to the poster of the male housing **10**. Both edge portions of the base member **61** of the shorting terminal **60** can be inserted into the attachment grooves **72**. As shown in FIG. **7**, a cut-away portion **73** is formed in a lower wall of the shorting terminal housing recess **70** in the left half of the lower portion of the hood **11**, this cut-away portion **73** being formed at a central portion of the shorting terminal housing recess **70** relative to the widthwise direction thereof. A posterior end face of the cut-away portion **73** forms a retaining member **74**, the stopping member **65** of the base member **61** of the shorting terminal **60** engaging therewith and thereby maintaining the shorting terminal **60** in an unremovable state.

As shown in FIG. **4**, the shorting terminal housing recess **70** is formed in the downwardly protruding portion of the hood **11**. Consequently, it is provided to the exterior of the fitting area R of the corresponding female housing **20**. As a result, the only portions of the shorting terminal **60** that are located within the fitting area R of the female housing **20** are the contacting members **64** of the resilient contacts **62**. As shown in FIG. **13**, the tapered contact releasing member **29** formed at the lower face of the female housing **20** (this being fitted into the hood **11**) makes contact with the resilient contacts **62** protruding into the fitting area R, the contact releasing member **29** pushing the resilient contacts **62** in a direction separating them from the male terminal fittings **12**.

As shown in FIGS. **4** and **7**, a misalignment preventing wall **75** protrudes upwards along the entire length of the anterior end of the lower wall of the shorting terminal housing member **70**. A protruding anterior end face of this misalignment preventing wall **75** forms a unified face with an inner face of a right half (relative to FIG. **4**) of a lower portion of the hood **11**, and joins therewith. The protruding anterior end face of the misalignment preventing wall **75** is located in a position whereby it forms an approximately unified face with the fitting area R of the female housing **20**. That is, the misalignment preventing wall **75** causes an opening area of a fitting end face of the male housing **10** to have approximately the same shape as the fitting area R of the female housing **20**. As a result, the misalignment preventing wall **75** regulates the fitting movement of the female housing **20** when it is to be fitted into the hood **11**.

The present embodiment is configured as described above. Next, the operation thereof will be described. The shorting terminal **60** is attached to the male housing **10** before the two housings **10** and **20** are fitted together. As shown in FIG. **6**, the shorting terminal **60** is inserted from the posterior of the male housing **10** into the shorting terminal housing recess **70** via the attachment hole **71**.

Both edge portions of the base member **61** of the shorting terminal **60** are inserted into the attachment grooves **72** while the posterior end portion of the base member **61** is being pushed by a jig or the like. This pushes the shorting terminal **60** towards the anterior. The resilient contacts **62** are bent downwards, being guided by the posterior end portions of the male terminal fittings **12** and an upper portion of a hole edge of the attachment hole **71**. As they pass through the attachment hole **71**, the stopping member **65** of the base member **61** is guided upwards by a lower portion of the hole edge of the attachment hole **71**. As shown in FIG. **7**, the shorting terminal **60** is inserted to a depth whereby a posterior end of the stopping member **65** of the base member **61** reaches the cut-away portion **73**, the attachment of the shorting terminal **60** being completed when the stopping member **65** has engaged with the retaining member **74**, the shorting terminal **60** being maintained in a state whereby it cannot be removed from the shorting terminal housing recess **70**. At this juncture, the contacting members **64** of the resilient contacts **62** make contact with the tab-shaped anterior portions **12**A of the male terminal fittings **12**, thereby bringing the four male terminal fittings **12** located at the left side relative to FIG. **4** into a short-circuiting state.

Since the shorting terminal **60** has been attached to the posterior of the male housing **10** in the manner described above, an attaching jig does not interfere with the tab-shaped anterior portions **12**A of the male terminal fittings **12** located at the innermost portion of the hood **11**. Consequently, the jig cannot cause the male terminal fittings **12** to bend. Furthermore, the misalignment preventing wall **75** protrudes at the anterior end of the shorting terminal housing recess **70**, this making it difficult to attach the shorting terminal **60** from the anterior. In contrast, the shorting terminal **60** can easily be inserted from the opposite side into the shorting terminal housing recess **70** via the attachment hole **71**. Consequently, the shorting terminal **60** can easily be attached. Moreover, the bent portions **63** are provided on the anterior side (relative to the attaching direction) of the resilient contacts **62** of the shorting terminal **60**. Consequently, when the shorting terminal **60** is being attached, the posterior end portion of the base member **61** thereof can be pressed by a jig without this jig coming into contact with the resilient contacts **62**.

When the shorting terminal **60** is attached to the male housing **10**, since the misalignment preventing wall **75** is located to the anterior thereof, the shorting terminal **60** is not exposed to the exterior too much. As a result, when the male housing **10** stands alone as a single unit before the two housings **10** and **20** are fitted together, foreign objects are prevented from entering therein from the anterior and striking against the shorting terminal **60**. That is, the shorting terminal **60** is protected by the misalignment preventing wall **75**.

Next, the two housings **10** and **20** are fitted together. From the state shown in FIG. **2**, the female housing **20** is fitted into the hood **11** of the male housing **10**. As shown in FIG. **4**, the opening area of the fitting end face of the male housing **10** and the fitting area R of the female housing **20** have approximately the same shape. Consequently, if the female housing **20** is inserted into the hood **11** with its anterior face in an inclined state, this inclined state is corrected, and the female housing **20** is inserted correctly into the hood **11**.

As shown in FIG. **13**, the anterior portions **12**A of the male terminal fittings **12** make contact with the female terminal fittings **22** as fitting progresses, and the locking claw **13** of the male housing **10** engages with the tapered face of the locking protrusion **28** of the female housing **20**, this causing the locking arm **26** to bend into the bending space **27** provided therebelow. The contacting face **47** at the left side of the detecting protrusion **46** of the stopper arm **45** (this being in a free state) makes contact with the right side face **51** of the locking arm **26** (this being in a bent state), and the right side face **51** also making contact with the side face **53** of the main body **41**, thereby preventing the detecting member **40** from moving towards the left.

As shown in FIG. **14**, after the locking arm **26** has been bent, the releasing rib **17** that has been fitted into the recess **38** engages with the guiding face **48** of the detecting protrusion **46** of the stopper arm **45** (the detecting protrusion **46** is located to the posterior relative to the locking protrusion **28**; see FIG. **1** for the positional relationship between the two). The guiding face **48** guides the detecting protrusion **46** below the releasing rib **17**; this causes the stopper arm **45**

to bend downwards. At this juncture, as shown in FIG. **15**, the contacting face **47** of the detecting protrusion **46** and the side face **53** of the main body **41** make contact with the side face **51** of the bent locking arm **26**, thereby keeping the detecting member **40** from moving towards the left.

As shown in FIG. **16**, as the fitting progresses further, the contact releasing member **29** of the female housing **20** makes contact with the resilient contacts **62** of the shorting terminal **60**. The resilient contacts **62** bend downwards as they are pushed by the contact releasing member **29**, the contacting members **64** thereby being separated from the anterior portions **12**A of the male terminal fittings **12**. In this manner the short-circuiting state of these four male terminal fittings **12** is released.

As the fitting of the two housings **10** and **20** is completed, the locking protrusion **28** engages with the anterior side of the locking claw **13**, and the locking arm **26** bends upwards out of the bending space **27**. At this juncture, the contacting state of the side face **53** of the main body **41** and the side face **51** of the locking arm **26** is released. As shown in FIGS. **17** and **18**, the detecting protrusion **46** is pushed downwards by the releasing rib **17**, which maintains the stopper arm **45** in a bent-down state at a height allowing it to be inserted into the bending space **27** below the locking arm **26** (this locking arm **26** having returned to its original position). As shown in FIG. **19**, the upper corner **49** of the contacting face **47** of the detecting protrusion **46** catches with the side face **51** of the locking arm **26** that has returned to its original position, this allowing them to be separated easily.

From this state, pushing the operating member **44** of the detecting member **40** towards the left causes the catching state of the corner **49** of the detecting protrusion **46** with the side face **51** of the bent locking arm **26** to be completely released, allowing the detecting member **40** to be moved towards the left. At this juncture, a force exceeding a specified amount must be exerted on the operating member **44** to move the detecting member **40**. Consequently, the operator can determine that the detecting member **40** has been moved. Furthermore, the degree of force required is not so great as to impede the smooth movement of the detecting member **40**.

The movement of the detecting member **40** is guided by the protruding member **39** of the female housing **20** which fits with the groove **42** of the detecting member **40**. When the detecting member **40** is to be moved, the stopper arm **45**, in the bent state shown in FIG. **18**, is passed through the bending space **27** below the locking arm **26**, the detecting protrusion **46** at the tip of the stopper arm **45** passing through this bending space **27**. When it has reached the guiding groove **32** located to the left, the detecting protrusion **46** moves upwards and the stopper arm returns to its original position (see FIG. **21**). As shown in FIG. **22**, the detecting protrusion **46** that is located within the guiding groove **32** is housed within the cut-away portion **15** of the guiding rib **14** of the male housing **10**. Since the stopper arm **45** has returned to its original state, set-in fatigue does not occur.

As shown in FIG. **21**, the catching member **50** at the right of the detecting protrusion **46** catches with the left side face **52** of the locking arm **26**. As a result, the detecting member **40** is prevented from moving even if a force pushing it towards the right is mistakenly applied thereto. Moving the detecting member **40** to the position shown in FIGS. **20** and **21**, in the manner described above, allows one to ascertain that the two housings **10** and **20** have been correctly fitted together.

The two housings **10** and **20** may need to be separated for maintenance or the like. In such a case, a jig is first used to bend the stopper arm **45**, releasing the catching member **50** of the detecting protrusion **46** from its catching state with the side face **52** of the locking arm **26**, the detecting member **40** returning to its original position (see FIG. **18**). After the detecting member **40** has left the bending space **27**, the pushing operating member **30** is pushed downwards, causing the locking arm **26** to bend downwards. As a result, the engaged state of the locking protrusion **28** with the locking claw **13** is released, and the two housings **10** and **20** can be separated. As the two housings **10** and **20** are separated, the resilient contacts **62** of the shorting terminal **60** again make contact with the anterior portion **12**A of the male terminal fittings **12**.

In the embodiment described above, the misalignment preventing wall **75** is provided at the anterior end of the shorting terminal housing member **70**. Consequently, the opening area of the hood **11** of the male housing **10** can be the minimum required to allow the female housing **20** to fit therein. Moreover, the fitting position of the female housing **20** is regulated when the two housings **10** and **20** are to be fitted together. Furthermore, the shorting terminal **60** is protected by the misalignment preventing wall **75** when the male housing **10** is still a single unit. That is, the misalignment preventing wall **75** has two functions; it increases the stability of the fitted female housing **20**, and it protects the shorting terminal **60**. The configuration used to add these two functions to the connector remains simple.

The shorting terminal **60** can be attached to the male housing **10** from the posterior, via the attachment hole **71**. As a result, the jig used for attaching the shorting terminal **60** cannot accidentally enter the hood **11** and make contact with the anterior portions **12**A of the male terminal fittings **12** protruding into the hood **11**. Consequently, the jig cannot bend the male terminal fittings **12** accidentally.

The present invention is not limited to the embodiments described above with the aid of figures. For example, the possibilities described below also lie within the technical range of the present invention. In addition, the present invention may be embodied in various other ways without deviating from the scope thereof.

(1) In the embodiment described above, when the shorting terminal is to be attached to the male housing, the posterior end portion of the base member thereof is pushed by a jig. However, the posterior end portion of the base member may equally well be provided with, for example, a bent portion protruding upwards at a right angle, the attachment operation being performed by pressing a posterior face of this bent portion with the jig. This would increase the contact area for the jig, thereby making the attachment operation easier.

(2) In the embodiment described above, the shorting terminal is attached to the male housing. However, the present invention is equally suited for a case whereby the shorting terminal is attached to the female housing. That is, a type of connector whereby the male housing is fitted within a hood of the female housing is equally suitable.

What is claimed is:

1. An electrical connector comprising

a first housing having an integral hood defining an open space;

a second housing insertable into the open space in a fitting direction and to a fully fitted condition wherein a substantial portion of the second housing is received into the open space defined by the hood;

a plurality of terminal fittings disposed in the first housing and protruding into said open space;

a resilient shorting terminal disposed in the first housing and having a bend and one or more resilient contacts,

said shorting terminal being in contact with two or more of said terminal fittings, and said shorting terminal being adapted to be separated from said terminal fittings when said second housing is in said fully fitted condition; and

a wall at the mouth of said hood, said wall being integral with the hood and extending into said hood substantially transverse to said fitting direction, said wall overlapping said shorting terminal in a direction transverse to said fitting direction and shielding substantially the entire bend of said shorting terminal, and said wall tending to align the second housing during insertion into the open space.

2. A connector according to claim **1** wherein said shorting terminal is "C" shaped, the bend is adjacent said wall and one arm of the shorting terminal comprises a resilient shorting member for said terminal fittings.

3. A connector according to claim **1** wherein said first housing includes an insertion aperture for said shorting terminal, said aperture facing outwards in the opposite direction to said hood and facilitating installation of the shorting terminal from a posterior face of the first housing.

4. A connector according to claim **3** wherein said aperture defines the mouth of an insertion recess extending in said fitting direction, said recess having guide grooves on opposite sides thereof and extending in the fitting direction, and said shorting terminal being engageable in said guide grooves.

5. An electrical connector comprising

a first housing having an integral hood defining an open space;

a second housing insertable into the open space in a fitting direction and to a fully fitted condition wherein a substantial portion of the second housing is received into the open space defined by the hood;

a plurality of terminal fittings disposed in the first housing and protruding into said open space;

a resilient shorting terminal disposed in the first housing and having a bend and one or more resilient contacts, said shorting terminal being in contact with two or mare of said terminal fittings, and said shorting terminal being adapted to be separated from said terminal fittings when said second housing is in said fully fitted condition;

a wall at the mouth of said hood, said wall being integral with the hood and extending into said hood substantially transverse to said fitting direction and shielding substantially the entire bend of said shorting terminal; and

an insertion aperture for said shorting terminal disposed in said first housing, said aperture facing outwards in the opposite direction to said hood and facilitating installation of the shorting terminal from a posterior face of the first housing.

6. A connector according to claim **5** wherein said aperture defines the mouth of an insertion recess extending in said fitting direction, said recess having guide grooves on opposite sides thereof and extending in the fitting direction, and said shorting terminal being engageable in said guide grooves.

7. A connector according to claim **6** wherein said shorting terminal is "C" shaped, the bend is adjacent said wall and one arm of the shorting terminal comprises a resilient shorting member for said terminal fittings.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,575,775 B2
DATED : June 10, 2003
INVENTOR(S) : Teruaki Hasegawa et al.

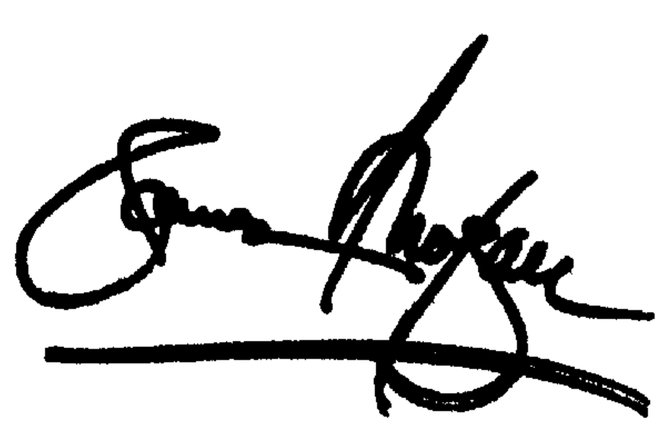
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [75], Inventors, "**Naova**" has been replaced with -- **Naoya** --;

Column 12,
Line 8, "mare" has been replaced with -- more --.

Signed and Sealed this

Twenty-first Day of October, 2003



JAMES E. ROGAN
Director of the United States Patent and Trademark Office